Heating and Ventilating

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

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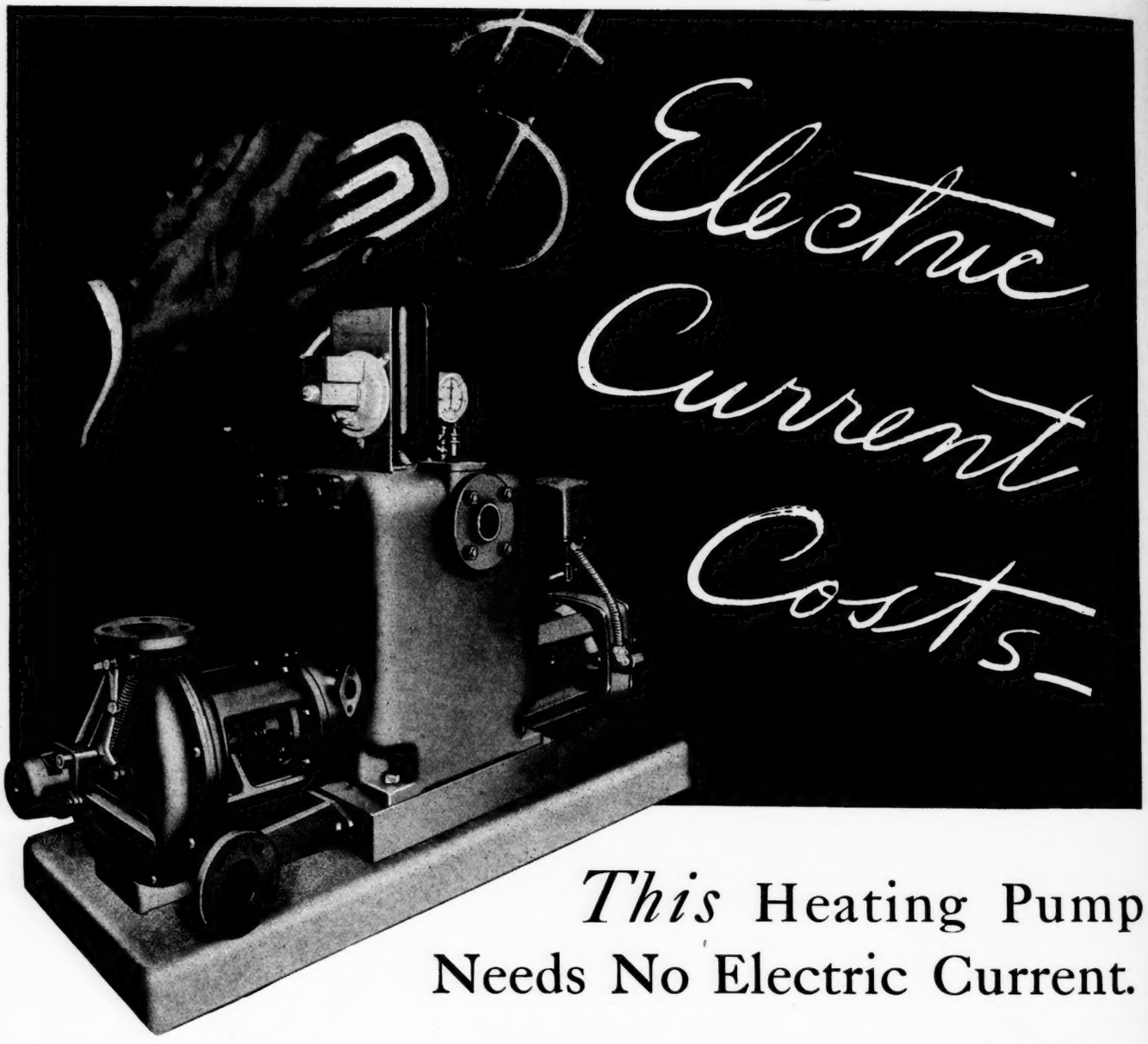

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Six Years of Degree-Day Records

THE degree-day as a unit on which to base fuel consumption data needs no introduction to readers of HEATING AND VENTILATING. It has been in fairly wide use for six or seven years, and its popularity is still on the increase, in spite of certain minor weaknesses in the premises on which the method is built.

Fuel consumption estimates based on the degree-day method assume that the quantity of fuel burned will be (with various corrections) proportional to the number of degrees the temperature falls below 65°, and that any year's total of these degree-days will be fairly close to the so-called normal for the given city. The use of the word normal in this connection cannot stand close scrutiny if highly accurate results are desired. This statement requires some explanation.

Each month the local weather bureau in a large number of cities publishes a summary of the weather in that city, included in which is the mean temperature for the month. These mean temperatures are for a period going back as high as 60 years in some cities, 30 years in others.

Some years ago summaries of the weather for these cities for the years prior to that time were calculated. Among the data worked up were the averages of the mean temperatures for these cities by months. This made available one figure as the mean temperature for every month of the 12, and this figure should be representative, inasmuch as it is an average over a long period.

The number of degree-days, as published in the "HEATING AND VENTILATING Degree-Day Handbook," for all cities, were calculated from these averages. The method used was to subtract the mean monthly temperature from 65° and multiply by the number of days in that month. That gave the so-called normal number for that month for that city.

In the spring and fall months in northern cities, and in many winter months in southern cities, a number of days in the month have a higher temperature than 65° and many lower. When the mean monthly temperature is calculated by the weather bureau, every day's temperature is included. The method of calculating the degree-days by daily temperatures does not agree with the monthly method previously outlined, because the daily method does *not* include the days when the temperature is over 65°.

For example, assume a case, simplified for purposes of illustration, where in a 30-day month the average daily temperature was 58° for 15 days and 70° for the other 15 days. The mean temperature for the month is thus 64°, so that this method shows 30 (65-64) = 30 degree-days for the period. On a daily basis, however, there were 15 (65-58) or 105 degree-days. In this case, by using the monthly mean we fail to include 75 degree-days.

Obviously, then, the monthly method is in error. The reason for using this method was to reduce the calculations necessary for 1000 cities, since the daily method would have required about 30 times as many calculations, even if the data would have been easily available, which they were not.

Investigation showed that the error with the monthly method was greatest in mild climates, and that in most cases the error involved was probably less than that in estimating heater efficiency and the correct amount of radiator surface, etc. For these reasons, then, the monthly method was used.

Since 1927, HEATING AND VENTILATING has been publishing each month during the heating season the number of degree-days calculated on a *daily* basis for the preceding months. These figures now cover six complete heating seasons for 24 cities. It is believed that a review of these daily figures may prove of value to those who are convinced that the climate is changing, and that the long-term normal is too high, or who recognize the slight inaccuracies of the normal figures.

The charts on the following pages show the fluctuations in the degree-day totals for the 24 cities for the last six years. These fluctuations, plotted vertically, are expressed in per cent of normal—normal being the long-period average figured on a *monthly* basis. Since the fluctuations are in per cent of normal, the 100-line represents normal.

In the table below the average number of degree-days per season for these cities for the last six years are given, as are the "normal," together with the percentage variation of the six-year average from normal. The figures in all cases cover only the period from September 1 to June 30, in all cases, regardless of whether or not there

Variations of Recent Degree-Day Totals from Normal

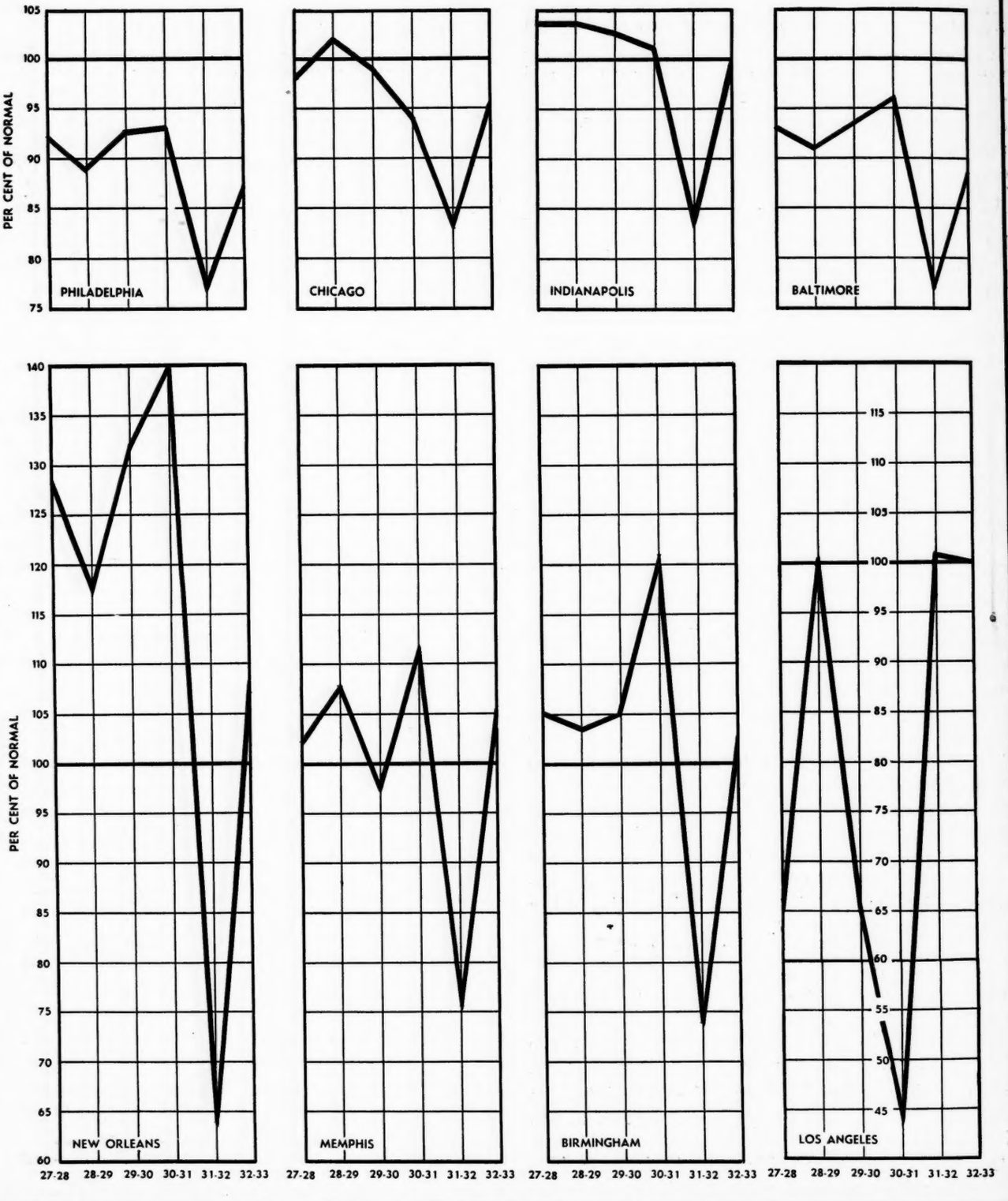
City	Degree-Days per Season, Average Last 6 years†	Degree-Days "Normal" Season†	Deviation of 6-Year Average from "Normal"
Atlanta	2,850	2,891	— 1.4%
Baltimore ...	4,079	4,533	— 10.0%
Birmingham .	2,473	2.408	+ 2.7%
Boston	5,402	6,045	— 10.7%
Buffalo	6 589	6.822	— 3.4%
Chicago	6,021	6,315	— 4.7%
Cincinnati ...	4,855	4,702	+ 3 3%
Cleveland	5,672	6,174	— 8.1%
Denver	5,952	5,873	+ 1.3%
Des Moines ..	6,169	6.373	— 3.2%
Detroit	6,113	6,494	— 5.9%
Indianapolis .	5,240	5,297	— 1.1%
Kansas City .	4,776	5,302	— 9.9%
Los Angeles .	1,793	1,504	+ 19.2%
Louisville	4 278	4,180	+ 2.3%
Memphis	2,954	2,950	+ 0.1%
Minneapolis .	7,634	7,851	— 2.8%
New Orleans .	1,175	1,023	+ 14.8%
New York ...	4,913	5,348	— 8.1%
Philadelphia .	4,300	4,855	— 11.4%
Pittsburgh ..	5,309	5,235	+ 1.4%
St. Louis	4,355	4,585	— 5.0%
San Francisco	2,623	2,876	— 8.8%
Seattle	4,825	4,884	— 1.2%

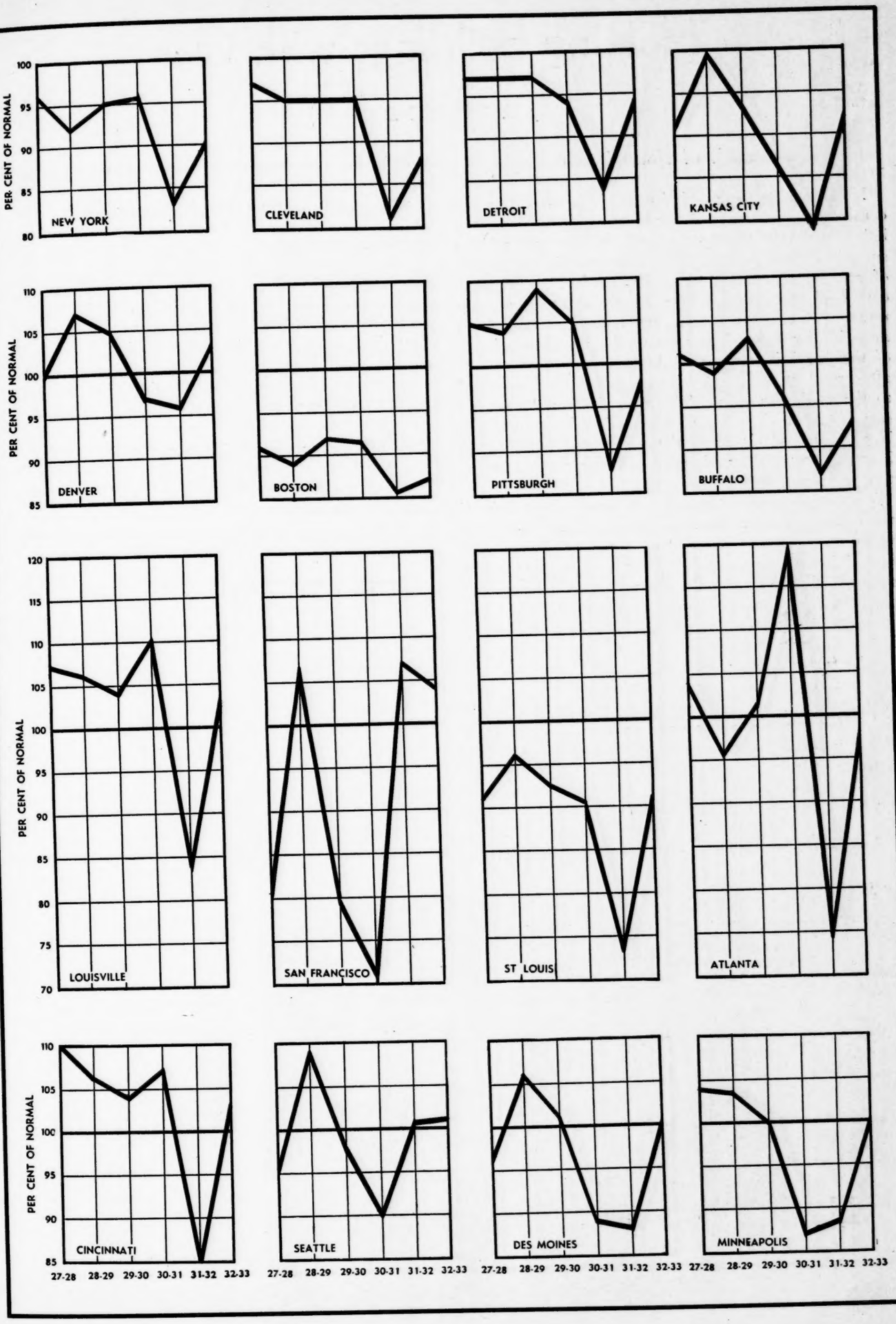
†Covers the period from September 1 to June 30 in all cases.

are degree-days during the other months. This shows whether the last six years' average has been running above or below the normal.

The most notable point brought out by the charts is that *in the case of cities with a very low degree-day total* (such as, for example, New Orleans) a few additional or a few less degree-days per season make such a large percentage difference that it would seem that the degree-day method is practically worthless for forecasting fuel consumptions. In the light of this we suggest that the figures for those cities be used with caution.

Fluctuations of Seasonal Totals of Degree-Days for 24 Cities for Six Years About Normal




PER CENT OF NORMAL
NEW YORK
CLEVELAND
DETROIT
KANSAS CITY
DENVER
BOSTON
PITTSBURGH
BUFFALO
LOUISVILLE
SAN FRANCISCO
ST LOUIS
ATLANTA
CINCINNATI
SEATTLE
DES MOINES
MINNEAPOLIS
27-28 28-29 29-30 30-31 31-32 32-33

Heating Buildings with Gas

By C. GEORGE SEGELER†

Growth of Natural Gas

IN retrospect, the gas industry should receive some considerable measure of thanks for helping American industry during the distressing last three years. The spread of natural gas, although hampered by the lack of credit and funds following the crash, nevertheless continued at a high rate in projects which were already under way and for which proper financing had been available by 1930. The pipe producers remained one of the few bright spots in the industrial picture long after production levels in other groups had dropped to the vanishing point. Therefore, it should elicit no surprise when the statement is made that natural gas is now available in 36 of the states, and further that it stands at the door of many of the important industrial centers not yet so supplied.

The rapid growth of natural gas sales is of importance to the heating and ventilating industry because there is always a great increase in the number of gas-heated installations subsequent to the introduction of natural gas. Not only are the prices for natural gas per heat unit generally lower than the prices for manufactured gas, but public acceptance of gas as a heating fuel is strongly influenced by the wide use of natural gas for such purposes.

It is also significant to note that there is considerable use of mixed natural and manufactured gas, thus providing for continuity of service and flexibility in case of fluctuations in supply, which will prevent some of the experiences of 25 years ago when natural gas was first used for house-heating purposes. At present the organization of geologic knowledge, coupled with the use of collecting and transmission lines stretching over long distances and covering many gas fields, provide assurance for the continuity of gas supply for long periods.

†Engineer of Utilization, American Gas Association, New York.

Natural Gas as a Heating Fuel

Heating buildings with natural gas presents no novelties, no striking changes, but that does not mean that the facts should be in any way overlooked. Where gas is available, it is the fuel which has the finest form value and, consequently, finds wide acceptance not only in the heating of private dwellings, but also in all kinds of public buildings, offices, factories, and wherever space must be kept at livable conditions. During the past few years new construction has been at a rather low ebb except in the case of government buildings and, consequently, the installation of natural gas for heating has principally been in residences, together with a substantial share of the new government construction.[1] In this latter field an important concession has been made by the Government in recognizing that gas prices are "delivered prices," whereas bids for coal have usually been at the mine with a separate bid for transportation which is not chargeable against fuel and, consequently, formed an unfair basis for comparison. Correction of this condition has resulted in a wide increase in the gas used in new government buildings. Examples of this are the school at the Indian Reservation at Bismarck, the Veterans Hospitals in Sheridan, Muskegon, and elsewhere.

Competition between gas and small stokers has been particularly keen during the last year, the comparison on a fuel cost basis alone being frequently favorable to the stoker firing. However, gas companies have met this competition by aggressive selling policies and by bringing to the customer's attention the items other than straight fuel cost which are involved in both coal and stoker firing. A paper by G. W. Turner[2] is par-

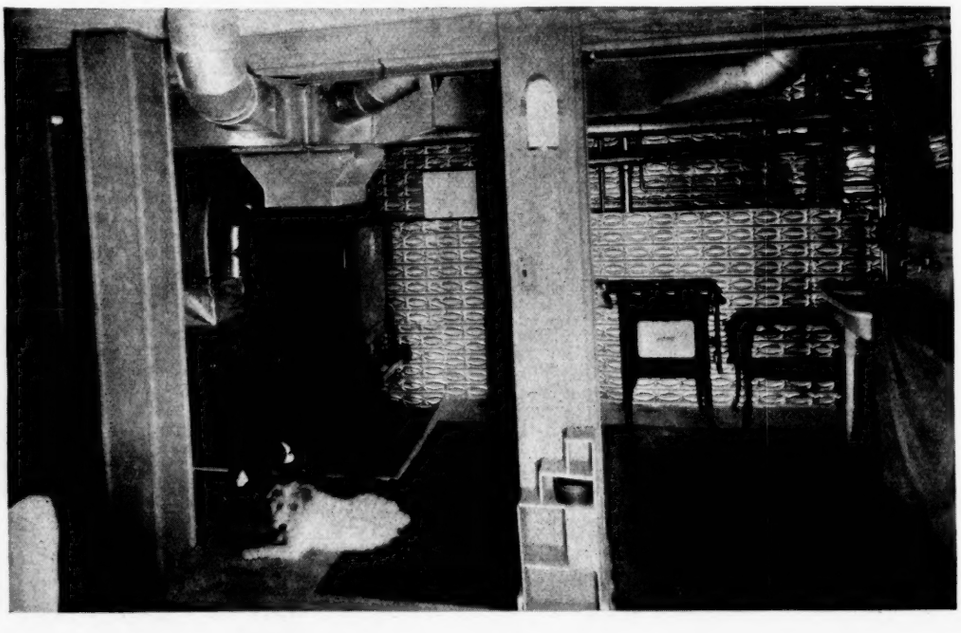


Fig. 1. After remodeling. Air conditioning furnace having humidification, filtering, and electric controls.

[1]Nevertheless, many notable changeovers from coal and oil to natural gas have been reported in commercial, institutional, and industrial buildings, as for example: five hospitals at New Orleans, La.; Blaw Knox Co., Pa.; etc.

[2] "Facing Facts of Competition in Commercial Gas Sales," *Gas Age Record*, April 8, 1933, pages 360-366.

ticularly valuable in pointing out differences in the maintenance and fixed charges which are involved when using gas and stoker-fired coal units. Apparently, the differences in amount of these costs are frequently higher than a casual study of the problem might indicate.

Lowering the Price of Gas

Lest the proceding material cause this article to be misinterpreted as the story of natural gas, it should be emphasized that in the manufactured gas industry new developments have also been taking place. In keeping with the times there have been substantial reductions in the average rate charged for house-heating gas, as well as a recognition of the generally competitive nature of the heating business on the part of utility executives. Rates as low as 45 cents per 1000 cu. ft. of manufactured gas (530 B.t.u. per cu. ft.) are in use in 1933, whereas a check with the A.G.A. Rate List of 1925 shows that the lowest house-heating rate in manufactured gas territory was then 70 cents per 1000 cu. ft. in the East. Denver, Portland, and Duluth had rates as low as 50 cents average for peak months.

In 1929, the first year for which accurate records are available, the average house-heating rate for manufactured gas[3] was 85 cents per 1000 cu. ft. The next two years show reductions of 4 cents in this average, and the 1932 average rate was down to 74 cents per 1000 cu. ft.

Equally interesting is the picture of the growth of special rates for house-heating which in 1925 numbered only 43; in 1930 they had increased to 456, and by 1933 there were 642 special rates of this class.

Another factor characterising the trend of gas rate structures during recent years is becoming manifest and will be of interest to the heating and ventilating profession. This has been the rapid spread of rates based on heating value rather than on gas volumes. They are called therm rates, and a therm, as defined by the gas industry, is that volume of gas which contains 100,000 B.t.u. At the present time 44 companies, serving more than 400 cities and towns, have adopted this method of billing.

One of the objections which has been raised to gas heating, particularly by sellers of competitive fuels, is based on the psychological reaction of the customer who is receiving bills by monthly periods which will naturally be in proportion to the heating demand for that month. In certain localities the worst month of the year, say January, may represent as much as 20% of the entire fuel requirements for the season. Correspondingly, the January gas bill would be inordinately high and, in conformity with natural human impulses, the customer boasts or complains about the severity of the gas bill when he is really stating his January gas bill and not the average. To overcome this disadvantage a number of methods of equalizing the heating costs have been proposed. A typical scheme which has recently been put into effect works as follows:

An equalization amount is set up equivalent to $9 per annum for each 50 sq. ft. of steam radiation or its equivalent of the customer's heating requirements. One-sixth of this amount is added to the customer's regular gas bill for August, September, and October. Nothing is added or subtracted from the November bill. On the December, January, February, and March bills, one-quarter of the equalization factor is deducted. Nothing is done in April, and one-sixth of the equalization factor is again added for the May, June, and July bills. By this plan no fixed estimate is set for the customer. The amount of money advanced by the customer and the time this is held by the gas company is equally balanced by the amount of money advanced to the customer and the time he has had the use of this money. This plan is simple to operate and is apparently meeting with a very favorable reception.

Another company makes very interesting use of the degree-day tabulations month by month to keep the customer posted on the variation of his bill with changing weather. The gas bills sent out by this company carry a calendar on the left hand side showing the comparative degree-days month by month for a 50-year average and for the past five seasons. The bill itself includes not only the amount of gas and the cost but the degree-days during the billing period. This company reports that the customers have been very well pleased with this simple and satisfactory method

[3]Determined by dividing the revenues from sale of manufactured gas for house-heating by the total number of cubic feet sold.

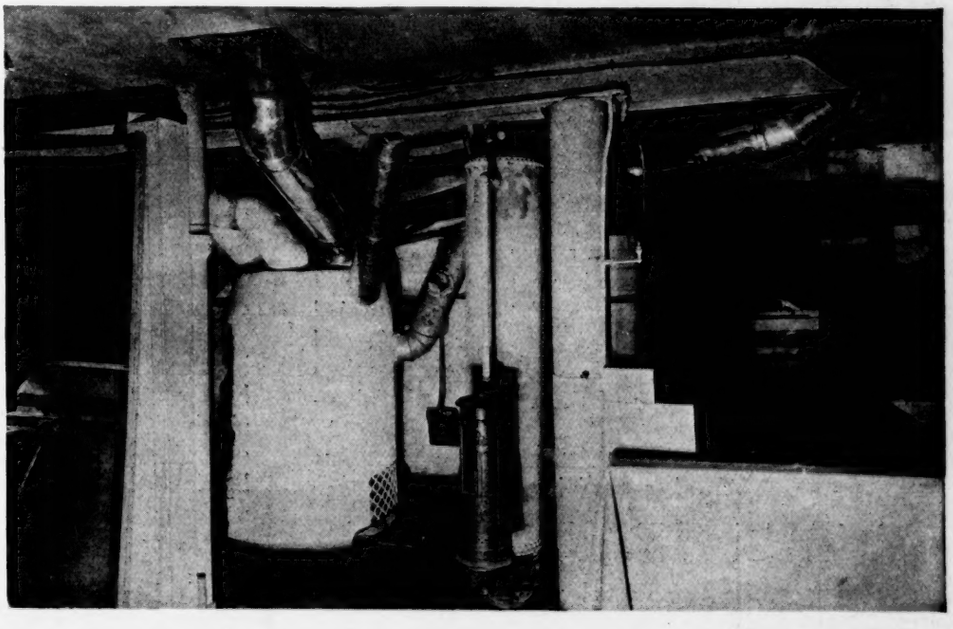


Fig. 2. Before remodeling. Coal-fired warm-air furnace in same cellar shown in Fig. 1. Gas water heater shown in center was replaced by a copper tank storage heater hidden by the center pole in Fig. 1.

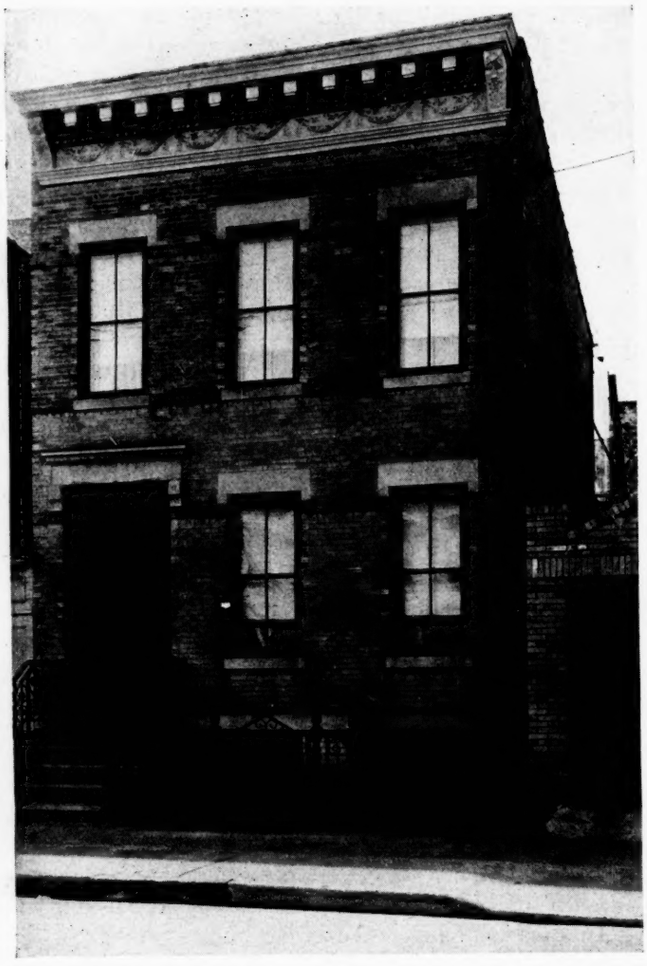


Fig. 3. Exterior view of home, basement of which is shown in Figs. 1 and 2. This illustrates the idea that gas is being installed in very plain homes.

of keeping them posted on why the bills vary from month to month. Incidentally, some customers who are technically minded and who check their bills very carefully divide the gas used for the month by the degree-days reported for that month, thus obtaining a unit figure of cubic feet per degree-day. Of course such a figure should not vary materially from month to month. The practice of showing the degree-days on the gas bill was adopted because on two previous occasions when the winters were abnormally warm, an exceptionally cold February or March caused gas bills to vary in a puzzling fashion. To explain this to customers, a letter was sent setting forth the situation. This proved so satisfactory that the present plan of billing was adopted.

The value of this system was rather strikingly proved this last year when in September a reduction of 30% in the heating rates was announced. As things turned out, October was 76% colder, November 124%, and December 55%, producing bills which were higher than the previous year, in spite of the very substantial reduction in the rate.

Selling Policies

It is obviously impossible to discuss in any complete form the various aspects of gas appliance sales within the limitations of a single article; in fact, the very extent of the gas heating business is such that conditions are not identical as one moves from place to place and, therefore, many different policies are in effect. Nevertheless, the gas industry is giving growing recognition as a body to the desirability of opening cooperative sales outlets and allies through whom the sale of gas will be increased. This program of cooperation will be further strengthened shortly by the adoption of A.G.A. listing requirements for conversion burners, whereby these appliances will be given official recognition by the gas industry as satisfactory and efficient appliances, just as recognized boilers and furnaces have been for a number of years. Provisions for testing conversion burners could not be established as easily as requirements for standard integral gas units because of the obvious difficulty of controlling the method of installation of conversion burners, which in turn would affect not only their efficiency but their safety of operation as well. This program has now been completed, and listed conversion burners will shortly appear which, when installed in accordance with the A.G.A. Requirements for the Installation of Conversion Burners, will give satisfactory and efficient service.

By reason of its relatively lower first cost, the conversion burner will fit into the dealer sales plans perhaps even more readily than the gas-designed units. It is interesting to draw a parallel between this situation and that in the oil burner field, where efforts to improve the efficiency and unity of the oil-burning device finally led to the appearance of oil-designed boilers, whereas in the case of gas heating it was the integral unit which preceded the conversion unit. This difference is easily explained from the point of view of the manufactured gas industry, where it was necessary from the first to lay great stress upon the highest possible thermal efficiencies, whereas with the improvement in the conversion burner and the lowering of the gas prices, any slight difference in efficiency between the two types of systems is no longer so significant.

TABLE 1

AVERAGE HEAT CONSUMPTION PER 1000 B.T.U. HOURLY HEAT LOSS OF 700 GAS-HEATED INSTALLATIONS

Type of Installation	B.t.u. per Degree-Day per 1000 B.t.u. Hourly Heat Loss From the House
Gas-designed hot water boilers	404
Gas-designed steam boilers	445
Converted hot water boilers	452
Converted steam boilers	503

As a matter of fact, a study presented before the A.S.H.V.E. last June[4] gives a complete picture of the position, as far as thermal efficiency goes, of the two types of systems. A careful survey was made of 700 private residences in 25 cities, taking data from the gas company records on hot water boilers, steam boilers, converted hot water boilers, and converted steam boilers. The unit results of gas used are expressed in B.t.u. input per degree-day for each 1000 B.t.u. estimated hourly heat loss from the house. The actual results obtained from the survey of 700 private residences are given in Table 1. These figures show overall seasonal heating efficiencies from a maximum of 91.6% to a minimum of 73.5%. They also show that the overall results of hot water equipment are 10% better than

[4] "Automatic Gas Burners," by C. G. Segeler.

steam equipment and that the difference between the average efficiency of all gas-designed versus converted equipment was about 12% in favor of the gas-designed equipment.

The place of the conversion burner by reason of its low first cost and relatively minor difference in operating cost is thus definitely assured, and the appearance on the market of conversion burners manufactured by old-line and conservative boiler builders is another clue toward the trend that is taking place.

With the exception of the large number of sales of gas-designed space-heating units of various types, particularly in the Southwest and West, the conversion burner sales outnumber by a wide margin the sales of the gas-designed heating systems. Accurate statistics are not yet available on the total installation sales, but the sales of boilers and furnaces have been reported to the Gas Heating Boiler and Furnace Association, whose statistical department reports are summarized in Table 2

TABLE 2

SALES OF GAS-FIRED BOILERS AND FURNACES

(Reported by 14 Manufacturers to the Gas Heating Boiler and Furnace Association)

Gas-Fired Boilers

Year	Sales, Dollars	Sales, B.t.u. Capacity	Shipments, No. of Units
1927	$2,702,799 (b)	(a)	(a)
1928	2 663,931	2,153,980,900	10,600 (c)
1929	3.558,704	2,838,900,569	13,900 (c)
1930	3,069,442	2,607,862,900	12,700 (c)
1931	1,931,774	1,856,995,295	9,102
1932	725,016	769,903,900	3,586

Gas-Fired Furnaces

Year	Sales, Dollars	Sales, B.t.u. Capacity	Shipments, No. of Units
1927	(b)	(a)	(a)
1928	$449,677	310,072,925	2,309 (c)
1929	733,538	484,130,535	3.605 (c)
1930	780,323	522,950,130	3,894 (c)
1931	490,708	363,407,585	2,706
1932	317,185	212,189,900	2,039

Notes: (a) Not available.
(b) Furnace sales included in boiler sales.
(c) Estimated.

In the field of large heating installations, gas-designed units are only used in new installations, or more rarely, as replacements. The usual procedure is to use gas burners of a special type designed for large boiler conversions. Such burners and their controls are quite distinct from the small house-heating conversion burners since the combustion problems involved are altogether different. These burners fall naturally into two classes, dependent upon the use of natural draft or blast. The choice is governed by initial cost, flexibility, and ease of application and adaptability to automatic control.[5] The selection of controls hinges on whether or not on-and-off or throttling combustion is employed, the simplest controls being the on-and-off type, provided that attention is given to the problem of puffing sometimes encountered, especially in the larger boilers. With blast equipment, control is simple, as it is merely necessary to start and stop the air blower at a predetermined steam pressure, controlling the flow of gas by means of a diaphragm valve actuated by the blower air pressure. The control of the damper need not be considered, as the firebox draft can be adjusted to about 0.02 in., causing very little air infiltration during the off periods. With natural draft, however, this form of control cannot be used, since failure to control the damper in the off period would cause a high cold air flow because of the draft produced by the chimney. Therefore, with a natural draft installation of either the throttling or the on-and-off type, it is becoming customary to use secondary air control.

Typical conversions of downdraft firetube and water tube boilers operating at pressures up to 125 lb. per sq. in. have shown efficiencies to run between 72% and 75%, as a rule. Even when the boiler is operated at a low per cent of full rating, good results are obtained because of the degree of control over excess air which can be effected with gas burning. Of course, uninsulated boilers would not show as flat rating-efficiency curves, but the more usual insulated type of boiler has an extremely flat curve.

For large boilers with brick settings—particularly if these have been in use for some time—the problem of air infiltration becomes increasingly important. An automatic proportioning type burner is considered to be very satisfactory for such cases since air-gas ratios at a uniform level and a positive pressure in the firebox can be maintained. This scheme offers an additional advantage in promoting a high rate of heat transfer which tends to raise operating efficiencies to a very high level. Partial load operation has a much smaller effect on the efficiency of an automatic proportioning burner than burners having a variable air-gas ratio.

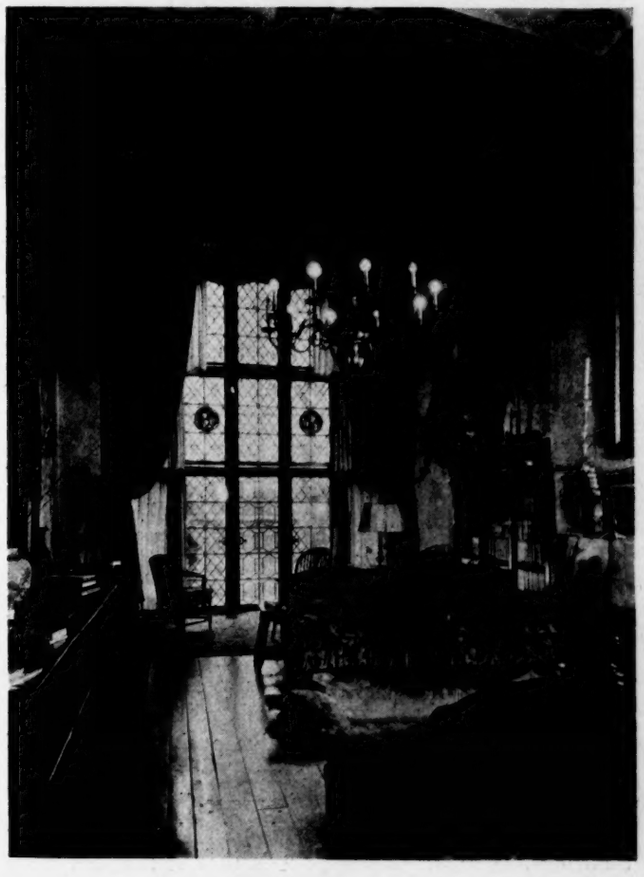


Fig. 4. High-ceiling room in old-fashioned brownstone-front, equipped with new gas-fired conditioner.

[5] "Application of Gas Fuel to Coal-Fired Boilers," H. F. Rehfeldt, *A.G.A. Monthly*, April, 1933.

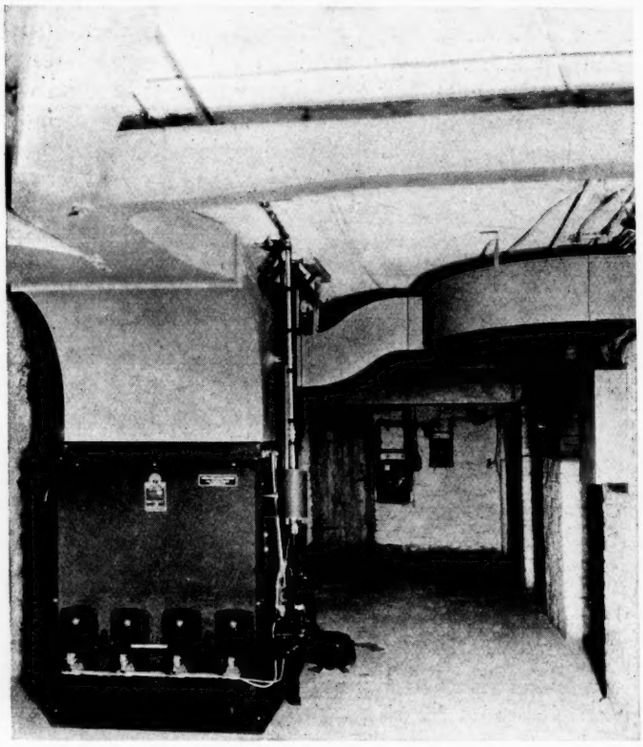


Fig. 5. Cellar shown in Fig. 7 after installation of the gas-fired conditioner.

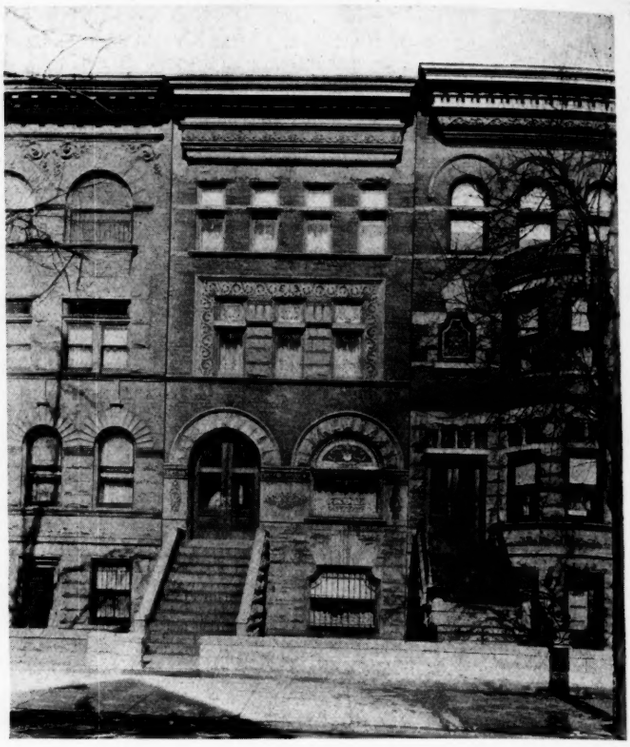


Fig. 6. Fuel consumption in this typical brownstone-front in New York was estimated at 415,000 cu. ft. of 540 B.t.u. gas, but actually only 178,000 cu. ft. were used.

Sometimes conversions are made so that change can readily be effected from gas back to coal firing, and vice versa. For example, one 300-hp. horizontally-baffled water tube boiler equipped with a chain grate stoker was converted to gas firing by introducing burners into the rear of the setting. The bridge wall was built up until it met the first row of tubes. To return to coal firing, it was merely necessary to remove the additional bridge wall and to protect the burner faces with a course of firebrick.

The use of promotional gas rates, particularly low-priced off-peak summer rates, has been a factor in increasing the number of installations of this type. Very often, however, the customer is so pleased with the gas operation that he extends it through a greater number of months than originally planned, and finally ends up by using gas as the all-year-round fuel.

Comparison of the efficiency of gas and coal application in various types and sizes of boilers was reported in considerable detail by G. I. Rhodes, vice-president of Ford, Bacon & Davis, at the 1932 meeting of the American Gas Association.[6]

While thermal efficiency remains an important problem for gas heating, it is really an increased overall or service efficiency which interests the consumer. It remained for a brand new sales policy to point the way in which this desirable result could be achieved, thereby improving the competitive position of gas and providing new business for a number of allied trades.

This policy will gradually improve living conditions and make for better construction in the case of new buildings. The surprising part is that it had not been more thoroughly accepted previously. The incident came about in this way.

The first private house to be completely air conditioned using gas was located in Pelham, N. Y., and was put into operation during the summer of 1931. That summer was plentifully supplied with excessively hot days, as conditions go near New York, and the customer had ample time to prove the satisfactory operation of his new unit. However, by the time the next summer had come around, it became evident that thorough insulation and weatherstripping would reduce the operating cost of summer air conditioning. What neither the customer nor the gas company realized, however, was the important effect of the insulation on the need for using the air conditioning equipment. This was one of the most surprising features of the installation of this conditioning unit in New York. The year 1932 was, to be sure, not quite as hot as 1931, but even allowing for such differences, the use made of the cooler was proportionately very much less than might have been predicted from a mere consideration of the weather conditions in the two years.

It was this incident which led to the new sales policy, that of selling a gas-heating system not merely as a heating system but as a combination of insulated house, weatherstripping, and caulking when necessary, and a heating system, even going so far as to provide storm sash in some instances. Of course, quotations on such a complete job are naturally higher than the quotation for a gas burner alone, but the total, particularly when quantity orders are involved, does not bring the first cost very much above that which a customer, for example, might have to spend for a new heating plant with an oil-designed boiler-burner unit. In some cases

[6] "Steam Generation," *A.G.A. Proceedings*, 1932, pages 631-4.

the gas company has financed such combination sales on the same terms offered for the financing of gas equipment sales. Close cooperation is maintained with companies specializing in the installation of insulation, weatherstripping, and double windows.

The customer who takes advantage of such a plan therefore secures very much more than a heating plant. He secures summer comfort to a marked degree. He automatically increases the effectiveness of his heating plant in the wintertime, which is particularly useful in case his building is under-radiated to begin with. It increases the speed with which he can bring the house up to temperature. In addition, he reduces the total gas consumption. The combination of these factors very often brings the cost of gas heating down to figures which are surprisingly low, even for manufactured gas territories.

To substantiate these points, calls were made on a number of customers who had accepted gas heating under such an arrangement. It was expected that the customers would be eager to tell how their gas bills had been reduced. Surprisingly enough, it was not the lower gas bills which caused the most comment. In each of several instances the customer's immediate reaction was to the effect that the house, and particularly the upper floors, was very noticeably cooler in the summertime.

Technical Improvements in Gas Heating

The position of gas in the house-heating field, as far as thermal efficiency goes, has been thought to be near the peak of its development. Structural and practical reasons would seem to indicate that the levels of boiler and furnace thermal efficiency are as high as practical.[7] To be sure, the design of gas burners and their gas applications has reached levels possibly surpassing that of any other fuel. Nevertheless, the past year has seen the introduction of efficiency-improving features. Most noteworthy of these is the device for controlling the flow of air through the chimney during the off-periods of the burners. The off-period has always introduced heat losses, since the combustion chamber then acts as a radiator. The losses were particularly marked in the case of steam boilers, but important for all types of heating equipment. To overcome this the automatic damper control actuated by gas pressure has come into use. This device consists of a diaphragm coupled with a linkage moving a flue damper. When the gas pressure is applied to the diaphragm, the damper has to open and as soon as the gas pressure falls off, the damper closes. The damper unit is simply installed in a 4-in. section of flue pipe.

In reviewing the question of thermal efficiency over a period of the last few years, it is interesting to see that manufacturers have gradually succeeded in increasing the ratings of their boilers without materially increasing the amount of cast iron in them. This has been done while still meeting the requirements of the A.G.A. in regard to efficiency, and all boilers approved by the A.G.A. are rated at 80% thermal efficiency. During recent months a reversal of this trend on the part of at least one manufacturer has been reported. In field and laboratory tests, work has been progressing to modify the gas equipment in the direction of lower ratings per unit of cast iron and at the same time considerably higher efficiencies. The competitive efforts of the last few years have forced the trade to the maximum possible ratings in order to keep the cost of equipment down. This step toward higher efficiency rather than emphasizing first cost is in the opposite direction. It is intended to improve efficiency beyond the required rated 80%.

Ratings per unit of cast iron will, undoubtedly, be lower in this new equipment, but operating economies should be effected to a marked extent. It is predicted that better than 10% improvement in the operating cost will result from this new de luxe equipment. Such a move would be equivalent to an appropriate reduction in the gas rate and will be of further assistance in meeting the competition of other fuels.

This whole development is an example of history repeating itself. In the early days of gas appliances designs were aimed at just that point; namely, to secure maximum efficiency, disregarding condensation, etc. As the industry grew, competition transferred the center of interest to the development of maximum ratings rather than maximum efficiencies, especially since all gas boilers that were approved were officially rated on the same basis of 80%. The new unit described above will be designed for the maximum practical thermal and operating efficiency. Of course it will bear the A.G.A. Laboratory Seal of Approval, but capacity ratings will be relatively lower than those of boilers of similar external dimensions.

In the field of temperature control, a long stride forward has been taken during the last year when the combination time and temperature change control appeared on the market. This new control operates in advance of the usual demand for heat. In other words, the basic elements of temperature change and time are so coordinated that an initial fractional degree of heat loss actually causes the burner to operate for a predetermined period. This operating period is just long enough to make up the heat loss. This arrangement prevents both over-shooting and under-shooting and controls the temperature with practically no variation. Essentially, this unit is a clock control thermostat in which every 30 min. a trial is made of the room temperature and if the temperature should be as much as ¼° below the thermostat setting, the burner will operate for 5 min. If the thermostat is satisfied, no burner operation will take place. This new unit will completely eliminate the uncomfortable "cold 70" and, in addition, by its preventing overshooting of the thermostat setting, will improve the economy.

Another control system which is meeting with some favor is based on the fact that in larger homes only a small portion is in use at any one time and, therefore, a zoning control will represent a considerable saving in fuel. Similarly, individual radiator or zoning control would be practical in smaller houses where the tenants sleep in cold bedrooms. Standardized equipment can be used to build these systems, consisting

[7] Approximately 80% with flue temperatures from 200° to 350° and not more than 25% excess air.

Fig. 7. Basement view of brownstone-front shown in Figs. 5 and 6 after coal furnace was torn out, before gas was installed.

either of a thermostat and a motorized valve on steam and water lines, or a motorized duct damper for warm-air systems.

Modulating controls, which have resulted in more uniform room temperatures as well as elimination of the "cold 70" problem, have also been found effective. Controls of this modulating type provide as many as 18 different positions of a valve in approximately a 2° plus or minus range, varying the amount of gas input to the boiler in proportion to the valve position.

Future of Gas Heating

The automatic heating field is considered to include all the buildings in America by the optimist, but unless a very substantial change in purchasing power occurs in the near future, past experience indicates that a much more restricted market is open.

When the market is considered in the light of gas sales alone, it is quite difficult to predict its precise extent because of the uncertain factor of natural gas, which broadens the market rapidly and beyond the limits normally considered practical for manufactured gas territory. For the purpose of estimation, however, it is clear that the best market for gas heating lies in the owner-occupied homes whose assessed valuation is above a minimum, say $5000 or $6000. If reference is made to any of the national surveys, it will be found that there are about 14,500,000 domestic gas meters in use in the United States, serving a territory in which there are estimated to be 8,000,000 owner-occupied homes. Since the automatic stoker and the oil burner dealers are also in this same market, the number of these units already in use should certainly be deducted from the potential. This leaves a rough balance of 7,000,000 homes. Granting all the advantages that gas possesses in the way of form value and other desirable characteristics, it is obvious that the gas industry concedes to the other fuels an important share of the total market; therefore, the estimation of potential gas sales and market could be made by taking one-half of this balance and deducting the number of homes valued at less than $6000.[8]

In a given locality such a survey should not be difficult to carry out, utilizing for that purpose the data of the local real estate chamber of commerce in regard to assessments and occupancy of homes, and then translating this into a market estimate. Such a method will be useful in estimating the expenditures which can be allotted to the house-heating work and in evaluating the eventual results of sales campaigns. Quotas can be established on fractions of this potential market, and the effect on the gas distributing and generating systems evaluated.

Even after the market has been restricted in the way outlined, it is clear that the future of gas space heating appears very promising. The following factors should be considered in studying the developments of the coming years:

a. Form value of gas.
b. Adoption of lower rates for gas.
c. Adoption of off-peak rates for gas for summer use.
d. Spread of lower priced natural gas.
e. Possibility of rising competitive fuel prices under a national program of inflationary character in which the utilities cannot participate as readily as the unregulated industries.

Air Conditioning with Gas

Public interest in air conditioning has been stimulated by this year's hot summer and the considerable amount of national advertising of air cooling equipment, even if the influence of the air conditioned movie palace as a constant reminder to the average householder were discounted. These factors promise that in spite of the severe competition encountered at this time, there remains every reason to believe that gas will share in every part of the heating and air conditioning fields.

Fig. 1 shows an air conditioning furnace which

[8]This empirical method should give a fair estimate of the potential market, even though there may be a number of sales in the lower price brackets. It does not mean that gas heating can *not* be sold in houses worth less than $6000.

is typical of the modern installations made with gas units in which the cellar is at the same time improved and remodelled. This figure, and Fig. 2, show an interesting comparison of how the installation looked before and after the use of a gas-fired furnace.

An excellent field for gas both for heating and conditioning all year 'round is found in the brownstone-front homes of the better type. Fig. 4 for example shows the living room of just such a home. This brownstone-front house has four stories and basement, and is 20 ft. wide and 75 ft. deep. The ground and first floors have a combined ceiling height of 19 ft. This house has a theoretical steam requirement of 384 sq. ft. of radiation. The installation replaced a gravity warm-air system, and some of the existing ducts were used in so far as the conditioning installation is concerned. The installation now consists of a combination of a gas-fired conditioner and a gas-fired water boiler. The boiler has a pressure type of water heating system which feeds the two heating elements in the conditioner with water at approximately 180°. Control is by a room temperature thermostat located in the living room, operating on the solenoid valve controlling the gas boiler. When the water temperature in the boiler reaches a certain predetermined temperature, the air conditioner fan is started, circulating warm air through the rooms. When the thermostat is satisfied, the action is reversed, the fan shutting off at a very slight temperature drop. Humidity control is by a humidistat. In this installation summer conditioning is obtained in part by circulating tap water as a cooling medium through the conditioner heating elements. The equipment is shown in Fig. 8.

Another development is the increased use of the gas conditioner with the typical warm-air construction, having no hot water unit as in the preceding case. Such units, equipped with the dual or two-stage thermostat, give quite satisfactory temperature and humidity control. Compact installation and neat appearance offer a big improvement over the older equipment in place. This installation is especially striking because of the photographs which were taken as the work progressed. Even though Fig. 7 was taken when the old coal furnace was partially disassembled, the general appearance of the cellar was not attractive although the broken brick and casings were only temporarily strewn around. Fig. 5 is the remodeled cellar after gas equipment was installed.

Frequent papers have been presented[9] on the application of gas to summer air conditioning, bringing out the effectiveness of such systems as the silica gel, which employs solid absorbers of air humidity and permits delivery of dehumidified air to the house. Such systems of course use gas as a controlled heating fuel for removing the moisture from the silica gel beds and revivifying these for continuous operation. These articles have not brought out as pointedly how rapid the increase in new installations has been, nor how the dehumidified air can be utilized for industrial use.

With an ample supply of cool tap water, sufficient direct cooling can be obtained that the dehumidified air can be discharged as cooled, dehumidified air into the house. With insufficient or warm tap water, the air can be dehumidified to a further stage and then cooled by re-evaporative cooling. Those who are thermodynamically minded can soon estimate with pencil and paper that each 17 grains of moisture re-evaporated into 1 lb. of dried air will cool this air 10°.

Standard methods of refrigeration are also applicable to such systems. A number of homes and public buildings have been equipped with one or another of these cooling and conditioning units for all-year-'round use, and they have proved their success from the technical viewpoint. The problem remains, not only for the gas industry but for all those interested in small house air conditioning, to overcome the present objections of high first cost and relatively high operating cost. As far as operating cost is concerned, the gas units stand in a favorable position, as has been reported by Milener[10] and others.

Up to the present, no one seems to have made use of any scheme of reversed-cycle gas refrigeration and heating, but this is clearly practical for gas operation as well as electric. As a matter of fact, a preliminary thermodynamic estimate will show that although the thermal efficiency of a gas-operated reversed-cycle heating unit is not more than one-fourth as high as that of an electric unit, there nevertheless are indications that the economic position of gas will be extremely favorable.

Such a scheme would in fact result in thermal efficiencies for house-heating, figured merely on the basis of the amount of gas used, in excess of 100% of the heat units delivered in the gas. Of course, this does not mean that there is anything like perpetual motion involved. It merely means that by the use of suitable refrigeration cycles the difference in temperature between the outside air, even in winter, and the temperature at which the refrigerating fluid will evaporate can be utilized to develop useful heat energy. From a practical viewpoint, this means that the development of such a system will be the same as lowering still further the cost of gas heating, besides providing a mechanism which can be utilized for all-year-'round air conditioning. This subject is now being studied by a number of engineers in this work, and a report will probably be issued at an early date.

Without losing sight of such possible future developments for gas, it might be well to consider an actual practical working installation in a restaurant. This is in no sense the first installation of gas for summer air conditioning, but it is a very recent one and it appears to be giving highly satisfactory results. Gas was selected only after considerable study of the various methods of cooling and humidifying available.

The installation measured about 13½ tons refrigerating load. The restaurant was small enough that individual cooling units could be considered. These would have cost approximately $2500 and represented the cheapest installation. The control of humidity would not have been sufficiently positive, especially when a large number of patrons were in the restaurant, and it

[9] Such as "Tellin' the Weather Man Where to Go," by E. D. Milener, before the Wisconsin Chapter, A.S.H.V.E., Milwaukee, May 22, 1933.

[10] Summer Air Conditioning with Gas Heat Energy," *A.G.A. Monthly*, March, 1933.

was therefore decided to go to a mechanical system with built-in distributing ducts, the cost of which was estimated between $4200 and $4500. The cost of both electric and gas systems was very nearly alike, with a slight margin (between 5% and 8%) in favor of gas. However, it was the operating cost comparison which made the favorable picture. Using a silica gel dehumidifier and tap water cooling, the seasonal cost, based on 450 maximum hours of use, worked out to approximately $325.[11] The electric operating cost for the same installation was estimated to be $566.[11] This installation is in a location where tap water at about 58° was regularly available, which made it unnecessary to use any mechanical cooling. The gas rate was 60 cents per 1000 cu. ft. of 540 B.t.u. gas; the water rate, $1.11 per 1000 cu. ft., and the electric rate, 4 cents per kw-hr.

The results were especially interesting because in another nearby restaurant a new electric air conditioning job was installed at the same time. A hot weather spell provided considerable opportunity to compare the actual operation in these two places.[12] These installations were about the same size and records have been taken on the humidity and temperature conditions which indicate a very hopeful future for gas.

Another gas installation is about to be made by the same company in the apartment of a doctor specializing in treatments which require considerable time, although the patients are not actually in-patients. The advantage of complete air conditioning for such work is obvious, and the doctor has been very favorably impressed with the humidity control offered by the silica gel unit. This installation will be in a 17-room apartment in an existing residential apartment house. It is planned to keep the temperature at 80° dry bulb and about 50% relative humidity. This installation will include a washer and a re-evaporative cooler with a small amount of direct tap water cooling (73° tap water). Incoming air as high as 95° will be discharged at 80° dry bulb from the gel unit. This air, carrying 46 grains of moisture, is permitted to pick up to 69 grains, thereby reducing the dry bulb temperature to 67°. This is the temperature at which the air is discharged into the various treatment and reception rooms. This temperature is needed to maintain the desired conditions in the apartment. The estimated cost of operation on gas will be about $360 per summer (the installation is approximately 15-ton size). This case breaks down to an hourly operating cost as follows:

Gas at 60 cents per 1000 cu. ft., 540 B.t.u.	**43.5 cents per hr.**
Water, 13 g.p.m.	**17.4 cents per hr.**
Electricity	**28.0 cents per hr.**
Total	**88.9 cents per hr.**

The total operating time is judged to be 90 days at 60% of maximum, or 400 hr. The estimated cost for this installation if an electric system were used was $1.03 per hr. Again fixed charges were disregarded, but the approximate costs were $6856 for the gas installation, and $5716 for the complete electric installation.

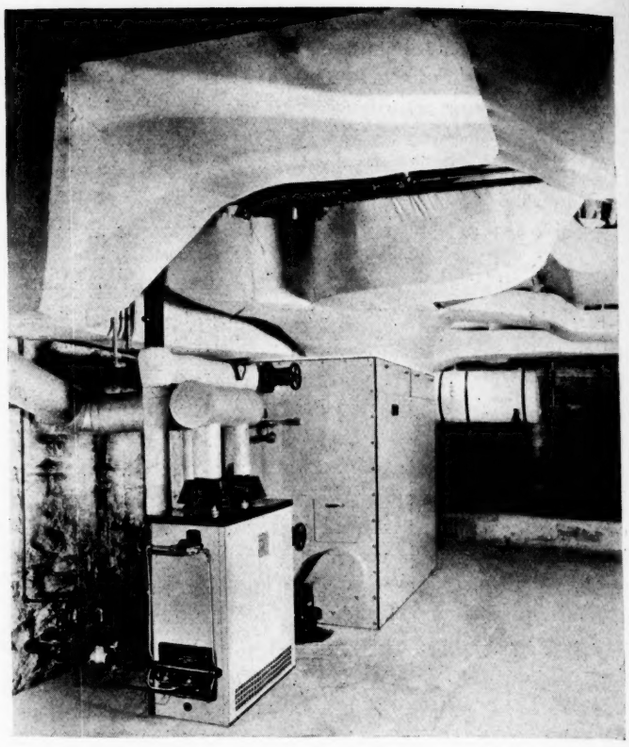


Fig. 8. Gas boiler and conditioning unit with former in the foreground. Such a system can be split, supplying warm-air ducts and also hot water to radiators.

The Challenge of Gas

The broad picture of the future of gas in the heating and cooling field is definitely tied up with the competitive position of gas in relation to other fuels. Since gas prices and heating value vary much more from one to another locality than do the prices of other fuels, it is of course difficult to establish general pictures. This much is certain, however, that the officials of leading utility companies are convinced that the gas house-heating and water heating markets represent the biggest potential fields for additional gas sales. It has also become recognized throughout the gas industry that the form and intangible advantages possessed by gas can only be utilized to a more or less limited extent as sales weapons. This condition is not considered normal by all of the informed opinion, but is attributed in part to the depression which has so markedly affected American buying habits. Consequently, there are clear trends shown toward competitive types of heating rates, toward more liberal terms for initial installation costs, and toward an increasing adoption of plans designed to enlist the aid of sales allies. In addition, there is a marked leaning toward the adoption of off-peak gas rates for summertime use of gas, which should prove a stimulus to gas summer air conditioning.

These tendencies viewed in the aggregate point the way toward a determined effort on the part of those engaged in the promotion of gas for heating and cooling to capture increasing proportions of the fuel business while at the same time offering to the heating and ventilating trade increasing opportunities for the sale of the necessary mechanical units and their installation.

[11] Fixed charges not included.
Connected gas load — 150 cu. ft. per hr. (540 B.t.u.).
Connected water load — 17.5 gal. per min.
Connected energy load — 4.5 hp.

[12] The men working on the installation noticed that shirts wet with perspiration from the excessive heat out of doors dried in about 8 min. in the gas conditioned restaurant.

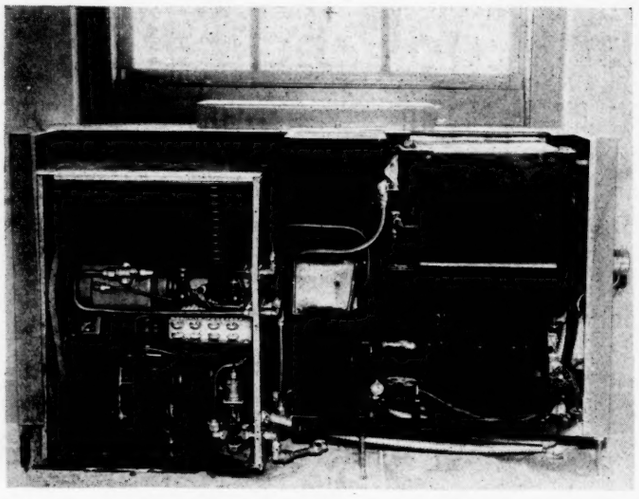
Unit Conditioners Heat, Cool and Filter Air in G. E. Building

General Electric Building, New York

ALTHOUGH cabinet room coolers have been more or less widely used in the last year or so, such units have not been commonly used for the dual service of heating and cooling. Further, although the application of such multi-purpose units to new buildings presents few difficulties, their application to an existing building, where the usual direct radiators are already in place, presents some problems. The completion of a fairly large and successful installation along these lines marks a noteworthy advance in unit air conditioning.

For this reason, the change-over of a number of offices in the General Electric Building, New York, has been observed with interest. This building, formerly owned by the Radio Corporation of America, and located at 570 Lexington Avenue, recently acquired by General Electric, is a 47-story building with a Gothic tower. Panel-type direct radiators were installed throughout the building as originally built. Following the acquisition of the building, the problem of air conditioning a number of the executive offices was referred to the company's air conditioning department. Their proposal, which was carried out and completed during the past summer, involved the use of the company's year 'round room air conditioners.

Spaces which are conditioned include the offices of Owen D. Young, chairman of the board; Gerard Swope, president, and other executive offices on the 43rd to 47th floors, inclusive. In addition, there are conditioned spaces on the 14th floor in the offices of the incandescent lamp department, on the 16th and 19th floors, where executive offices of International General Electric and New York district are located, and in the offices of J. J. Donovan, head of the air conditioning department.



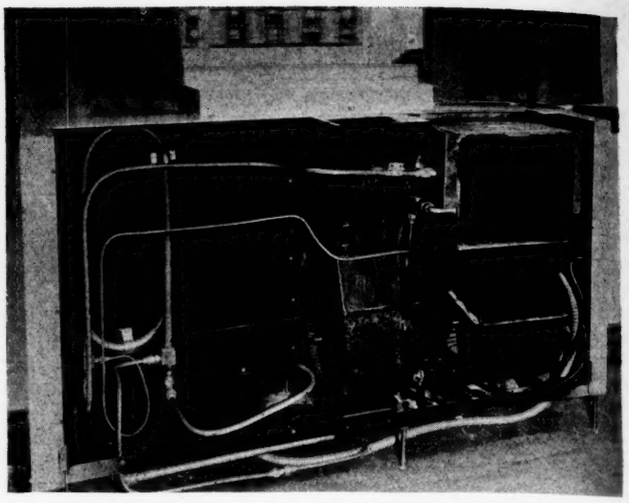


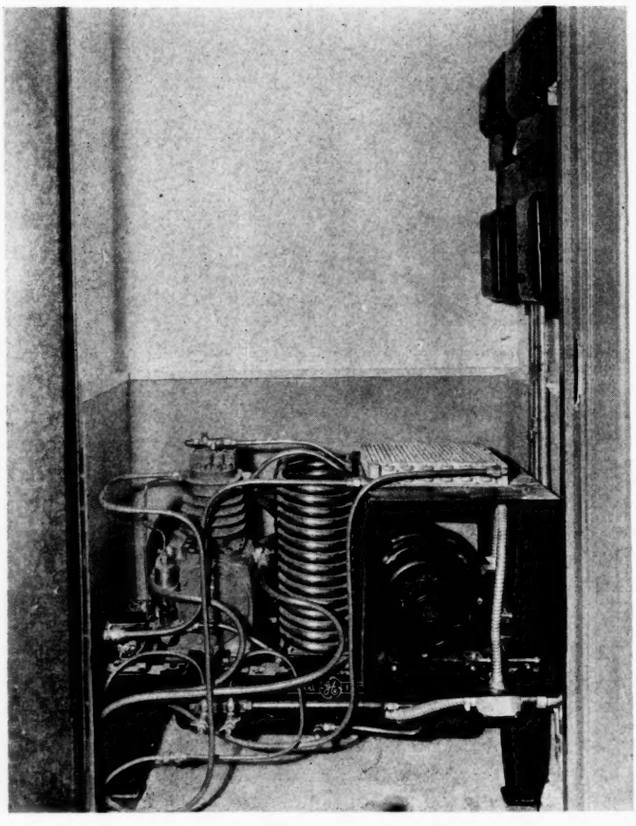
Fig. 1. (Left) Integral-type all-year conditioning unit with refrigerating machine at the left, conditioner apparatus at right. Fig. 2. (Right) Remote-type conditioning unit with refrigerating machine not shown but located in a nearby closet. Piping to the left includes the heat interchanger in which the refrigerant liquid pipe surrounds the suction pipe, preventing the latter from chilling adjacent air below the dewpoint which would cause condensation on the piping.

With the exception of a reception room on the 11th floor, the entire installation consists of unit-type conditioners with provision for all-year ventilating, filtering, and circulation; winter heating and humidifying; and summer cooling and dehumidifying. The units are also equipped with a silencing feature to reduce the amount of outside noise entering the conditioned spaces. The reception room on the 11th floor has no outside wall exposure and this room is summer air conditioned with a portable room cooler, without the heating feature.

All of the remaining units are supplied with refrigerant from a remote refrigerating unit, each of which is connected to several conditioners. In one office, however, an integral-type unit is installed, with the refrigerating machine located in the cabinet, as shown in Fig. 1.

Conditioning Units

With one exception, heat gain calculations were based on a 13½° temperature difference (78½ inside, 92°



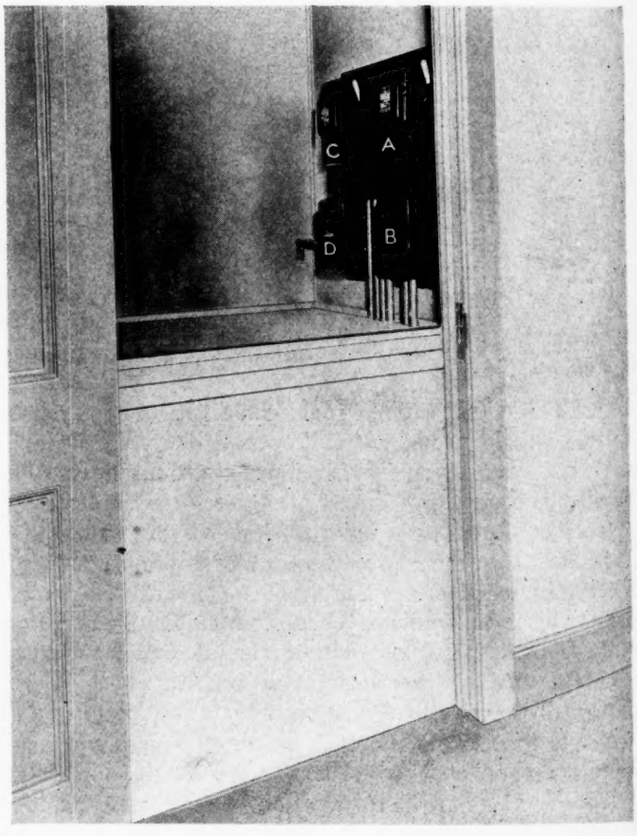


Fig. 3. (Left) Refrigerating machine, remotely located in closet, before being enclosed. Fig. 4. (Right) Refrigerating machine remotely located from conditioner cabinet, which it serves. Completed closet housing for remotely-located refrigerating machine. Insulating board completely encloses the unit.

Fig. 5. Finished installation of conditioners in office of J. J. Donovan, manager of air conditioning department.

outside). The total calculated tonnage of required refrigeration is 13.6 tons, with 17.6 tons installed.

Fig. 2 shows one of the cabinets of the remote type, as installed. In the upper right is shown the heat exchange surface, consisting of five tiers of extended surface, the top two tiers for heating, the lower three for cooling. A fan on the lower right forces air over the heating or cooling surface, while the fan in the lower center is used for ventilation. Outside air enters the box (shown between the curtains at the top) and drops vertically in the cabinet to the filter placed at an angle (as shown in the rear center of the cabinet). This ventilating air passes through the center fan, and upward through the silencer unit (in the upper center), and finally enters the room through grilles in the cabinet casing.

The ventilating system is independent of the remainder of the unit and can be entirely shut off, supply 200 c.f.m. at a maximum, or operate at half capacity to supply 100 c.f.m. Recirculated air is supplied to the right-hand fan entering the cabinet through grilles at the bottom. This fan has a capacity of 200 c.f.m., depending on the setting of the manual controlled three-speed switch. Thus, the unit has a maximum air handling capacity of 400 c.f.m.

In the space between the end of the cabinet and the heat exchange surface is a humidifier of the electrical-immersion type. The amount of moisture evaporated is manually controlled by a switch, on the end of the cabinet, supplying the 200-watt immersion heater.

Connections to the conditioning units consist of steam supply and return, refrigerant liquid and suction, drain, 120-volt single-phase power, and water line (for humidification).

Refrigerating Machines

The refrigerating machines, remotely located, are of two sizes, one being a two-cylinder type with a 2-hp. motor, the other having four cylinders and a 3-hp. motor. These units are placed in closets, many of which were designed for the purpose, as shown in Fig. 3. The closets were lined with 1½-in. insulating board, the complete installation appearing as in Fig. 4. Power supply switches and control relays were mounted in the closet, as shown in Fig. 3, and the water supply for condenser cooling piped to the closet from one of the existing water mains in the building. Since the operation of the motor driving the unit in a small closed closet made it necessary to dispose of the excess heat from the motor, a special water cooler was placed in series with the condenser, as shown above the motor in Fig. 3. Refrigerating lines were trenched in the floor from the closet to the condenser. The drains were trenched in like manner and carried to a common drain for the five tower floors. The water supply for the refrigerating machine also was trenched.

Controls

Temperatures in the winter are controlled by a thermostatic radiator valve to the heating surface. This valve is shown on the end of the cabinet in Fig. 1. Application of this valve and the slight rearrangement of piping made necessary from the old steam supply and return constitute the only changes made in heating system beyond that of replacement of heating surface.

Control of temperatures in the summer is by means of an electric clock thermostat. When the temperature rises above a predetermined point the refrigerating unit is started, supplying refrigerant to the unit conditioners, in which the manually-controlled fans are already running to supply ventilation. When the room temperature becomes cool enough to satisfy the setting the refrigerating unit is stopped. A time switch in the thermostat with predetermined settings automatically stops refrigerating unit in the evening and starts it in the morning.

Power Supply

Electric power is supplied to the refrigerating units through four lines, three-phase and neutral. The three-phase, 208-volt power is carried through a disconnect switch (See "A," Fig. 4) to a three-phase contactor ("B," Fig. 4). Single-phase, 120-volt power (one line to neutral) is carried through a disconnect switch ("C," Fig. 4) to the conditioner fans, to the transformer to supply low voltage for the clock thermostat, and to the relays ("D," Fig. 4) controlled by the clock thermostat.

Silica-Gel Plant Air Conditions Chicago Building

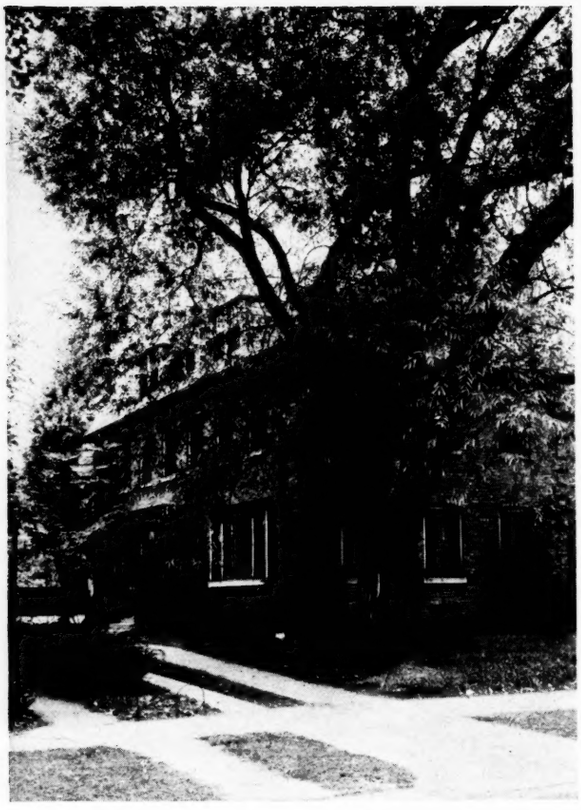


Fig. 1. Residence of M. A. Hirschl, Chicago, year-round air conditioned by a silica gel gas system.

SOME years ago the American Gas Association, in an endeavor to obtain operating data on the use of silica gel for air conditioning in connection with gas heating, installed a number of such plants in various parts of the country. One of these, located in Chicago, is in the home of Marcus A. Hirschl, an electrical engineer and patent attorney, who has supplemented the utility's studies by his own observations. The architect was Howard Shaw, of Chicago. The plant was designed by A. J. Canar, engineer, and the observations made have been carried through in association with H. B. Johns, of the house-heating department of the Peoples Gas Light and Coke Company, Chicago.

The house is a three-story brick residence. Floors one and two are surrounded by 12-in. brick walls, with third floor rooms built under an eaved roof, ceilings and side walls being treated with 4-in. insulation. All windows and doors are weatherstripped. The first floor of the house has an unusually large living room and dining room, with kitchen, halls, and lavatory. There are four bedrooms with bath on the second floor, and three bedrooms and one bath on the third. Outside dimensions of the house are 45 ft. × 23½ ft., with ceiling heights of 9 ft., 8½ ft. and 8 ft. on the three floors. The house contains 23,066 cu. ft., and there is a calculated 1,749 B.t.u. heat loss per degree difference in temperature.

The heating system consists of a 6-section gas-fired furnace, with one 9-in., two 12-in., and nine 10-in. ducts leading to registers in every room except one small bedroom on the third floor. In a few cases two rooms are fed from one riser. The one return duct leads from a 36-in. square grille at the rear of the first floor hall.

The original blowers were replaced by a main circulating blower of the air conditioning plant in the new installation. The furnace is equipped with an automatic humidifying device under gas-pressure regulation.

Dehumidification in summer is accomplished by means of silica-gel equipment whose overall housing dimensions are 5 ft. in height, 6½ ft. in length, and 3 ft. 4 in. in width. The rotary gel absorber is secured by bolts to a supporting frame in a manner which permits the gel cylinder to rotate three revolutions per hour. The gel cylinder is broken up into 24 pie-cut-shaped sections, with 12 on the absorption side at all times, and the other 12 being activated. The activation furnace is cylindrical with a conical top which connects by special duct to the rotary absorber. Nine sections

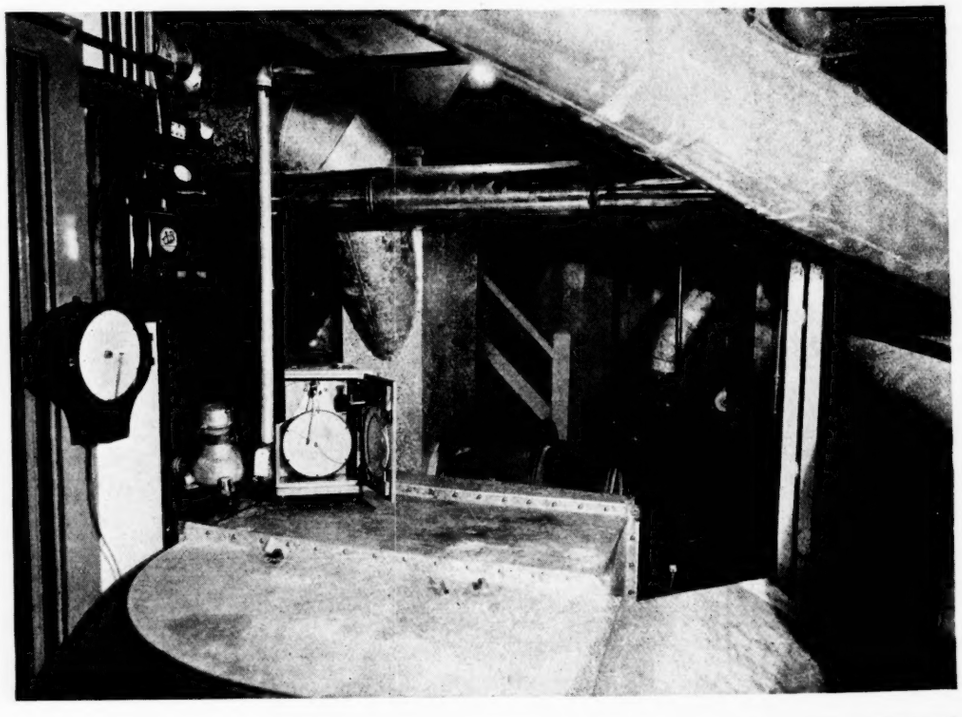


Fig. 2. Basement of the Hirschl residence with gas heater shown in rear left, instruments at left front, and fan at center rear.

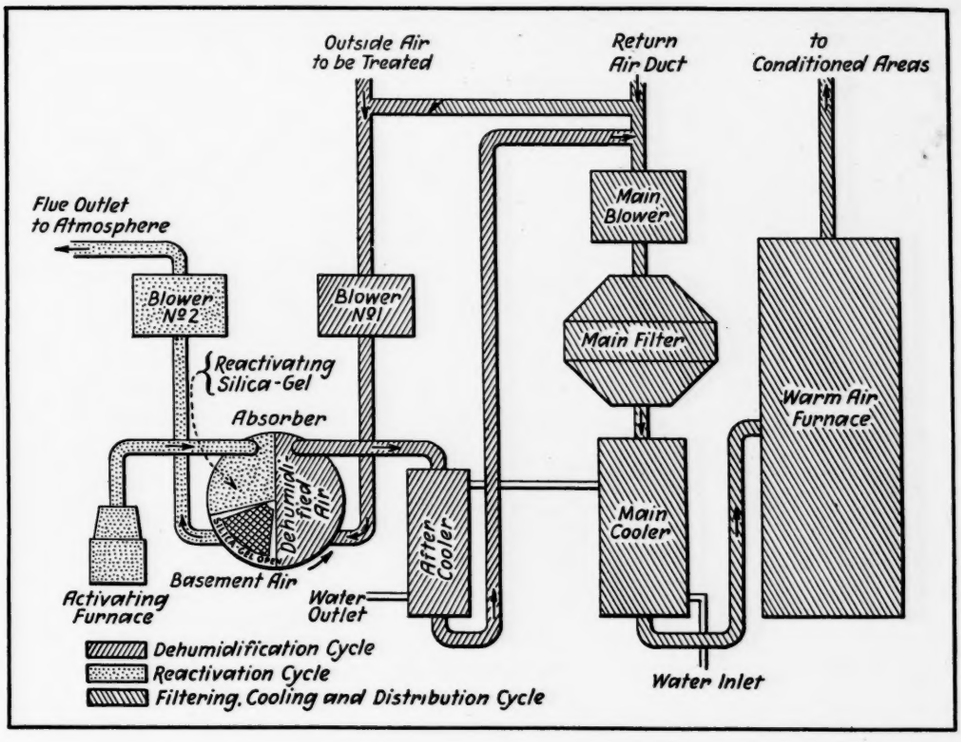


Fig. 3. Flow diagram of air conditioning plant, showing cycles of cooling and dehumidification of recirculated, filtered, conditioned air.

are thus deprived of their excess moisture at one time, and the other three are cooled by an air purge preparatory to their return to service on the absorption side.

The activation furnace is 22 in. in diameter. It is equipped with a safety pilot light, and consumes about 75 cu. ft. of 800 B.t.u. gas per hour. An opening allows admission of excess air to top of furnace so that abundant air is provided to vaporize the moisture absorbed from the gel and carry it out to the stack.

An inlet temperature of 300° is required for activation of the gel. A temperature cut-off is provided at this point. If temperature exceeds 400° the furnace is automatically shut down. Gases are vented to the stack at a temperature of 110°. Close to the activation fan discharge outlet a tight damper controls the amount of excess air to the amount necessary to give the required 300° activation inlet temperature.

The air to be dehumidified is forced through the gel cylinder by the absorption fan. When the air is dehumidified it leaves the absorber by way of a duct leading to the after-cooler. The process of absorption of moisture from the air gives off latent heat that raises its temperature to 110°–120°. When it leaves the after-cooler to mix with the return air it has been cooled to 70°.

A circulating fan of multiple-disc type operates by means of a double V-belt drive from a 1½-hp. motor, and its suction side connects to the main return duct. Glass wool filters, oil saturated, are arranged in a double row of four in the eccentric duct fitting between the discharge outlet of the circulating fan and the main cooler. Four sections of extended surface coil are used for cooling. Tap water circulates through the series of coil to cool the conditioned air, and discharge water is then used in the after-cooler before it goes to the sewer.

After the conditioned air is cooled in the main cooler, it passes through an eccentric fitting that connects to the rear of the gas furnace. It circulates through the furnace and thence through the distributing ducts to the various rooms of the house.

A branch duct is taken off the main return duct and connects to the outside air duct leading to the absorption fan. Both of these are equipped with tight fitting dampers so that either fresh air or return air or a mixture of the two can be dehumidified by the gel.

Two toggle switches control the operation of the complete plant. It is subject to control measures by humidistat alone or by combination of thermostat and humidistat. One toggle switch starts the gel unit and the other starts the circulating unit. This installation provides that when the air is only slightly uncomfortable and humidity is low, the circulating fan alone is used to recirculate the air. The water line in the main cooler is automatic when the circuit of the gel unit is on. It is manually-operated when recirculation is undertaken without dehumidification.

The gel unit treats 800 c.f.m. of air, which amounts to 48,000 cu. ft., or 3400 lb. of air per hour. The moisture-absorbing power of the gel on humidity is as follows:

Absolute humidity of air to be treated, in gr. per lb. of dry air	Per cent of moisture absorbed from the air by the gel
117	71%
79	78%
74	87%

Typical results of operation are as follows:

August 30, 1932	Temp.	Absolute Humidity	% less absolute humidity inside
Outside air	96	127 gr.	
First floor	81	84.5	33.5%
Second floor	83	90	29.0
Third floor	87	89	30.0
August 31, 1932			
Outside air	91	123	
First floor	79.5	75	39.0
Second floor	81	77	37.5
Third floor	85	85	31.0

The tap water temperature varied between 68° and 72°.

Operating Cost Data per Hour of Operation:

Water—40 cu. ft. per hr. @ 60c per 1000 cu. ft.....	2.4c
Power—1.9 Kw-hr. @ 3.7c per Kw-hr.	7.0c
Gas—70 cu. ft. —0.56 therms @ 8c per therm.....	4.4c
Hourly cost.....	13.8c

The owner reports that he has had no difficulty in maintaining air temperatures 10° below the temperatures outside, and it has been perfectly comfortable when conditions were highly uncomfortable outside.

Fig. 1. White House Swimming Pool looking toward the machinery room. The three concealed radiator panels are clearly shown.

Mechanical Equipment in the White House Swimming Pool

By ERNST H. BRANDT, JR.†

THE recently completed swimming pool at the White House in Washington, D. C., is located in the West Terrace of the Executive Mansion. Architecturally, the project has been illustrated and described in newspapers all over the country. The pool is 50 ft. long, 15 ft. wide, 4½ ft. deep at the shallow end, with a depth of 8 ft. at the opposite end, where the diving board is located. The walls are faced with architectural terra-cotta in varying shades of blue, changing to a pastel green above the water line. The plaster above the wainscoat and on the ceiling is a deep cream color.

There were several unique problems in connection with this installation which might be of interest to designers of mechanical equipment. The project was located entirely in an old building, involving some difficulties of excavation and construction because of the foundations and lack of space. This latter feature affected the mechanical arrangements to a considerable degree. Existing steam, water, sewer, and direct current electric lines, close by, were available for making the new connections as required.

The following conditions had to be met:

1. Water in the pool to be maintained at a constant predetermined temperature.
2. Incoming water temperature to be not more than 10° higher than the pool temperature.
3. Incoming water to be delivered into the pool without excessive velocity.
4. Space to be provided for future increases in amount of equipment.

Mechanical work started with the construction of a new steam manhole, 4 ft. square and approximately 8 ft. in depth. Existing underground lines running between the old State, War and Navy Building and the Executive Mansion were cut into for supplying the swimming pool with steam. A new expansion loop was installed in the 6-in. high-pressure steam line, with tee connection for the pool, and necessary cut-off and by-pass valves. Welded and flanged connections were used. New tees were also welded into the 2½-in. return and the 1½-in. summer steam lines. From this manhole, steam supply and return lines were run underground in split terra-cotta, into the lower level of the machinery room, genuine wrought-iron pipe being used.

Water supply for the pool was obtained by making

†President, Reliance Engineering Company, Inc.

a new connection to an existing 4-in. line in the basement of the Executive Office Building. The new line, also 4-in., was installed in the pipe tunnel connecting the office building with the Executive Mansion. For part of the distance the new line replaced a 2½-in. line feeding the office air conditioning equipment, all old connections being rearranged and tied into the new piping system. Sewer connections were made in the same pipe tunnel to an existing 10-in. sewer.

Steam and water connections were made at night to avoid interruption of these services. Steam connections were required to be completed before any ceiling work could be done by the builder, as an existing line on the old ceiling could not be disturbed since it supplied a portion of the heating system in the Executive Offices. A tee was provided in the new layout and early in the job the new connections were made and steam was being supplied, replacing the old line, thus permitting its removal. In making the water and sewer connections, some 30-in. concrete walls of the original pipe tunnel, constructed many years ago, had to be cut through, keeping an air drill busy for several days.

The machinery room was built in two levels, in the lower of which was contained the pumps, many of the control valves, and much of the piping system. There are three motor-driven pumps, two of the horizontal type, and one of the vertical shaft type. The two horizontal pumps are 2 in. × 2½ in. single-stage, double-suction, horizontal split casing type, complete with base and each directly connected by flexible couplings to direct current motors, operating at 1750 r.p.m. The capacity of one pump is 55 g.p.m. against a 40-ft. head; the other is designed for 110 g.p.m. against a 40-ft. head, when operating at the above speed. The pumps are fully bronze fitted, with the exception of the shafts, which are of stainless steel. Both are equipped with double suction enclosed impellers of the non-overloading type.

The 55-gal. pump is used for circulating the water in the pool. Water is pumped from the pool, through the orifice plates, which control the rate of flow as indicated on the gauges, through the filter, through the heater, thence through the sterilizer and returned to the pool, this being the normal operating cycle.

For back-washing the filters, the 110-gal. pump is used. Also about once each week this pump is used for cleaning the pool with a vacuum cleaning device, attached from two outlets in the suction header, ahead of the pumps.

Both pumps can be used for quick emptying of the pool to aid the gravity discharge. Since the pumps have four functions—circulating, back-washing, vacuum cleaning, and pool draining—units of proper design and characteristics were important and essential, so that the motors would not be overloaded under any operating condition from shut-off head to zero head.

The third pump is a vertical shaft submerged electric cellar drainage unit, to take care of the tunnel and miscellaneous drainage from a sump pit. This unit delivers 9 g.p.m. against a 22-ft. head and is self-contained and fully automatic, with motor and motor switch mounted on a cast-iron cover at the floor level. The pump is equipped with bronze impeller, self-aligning ball thrust bearing, and double pole operated automatic float switch.

Arrangements of piping and equipment in the lower level of the machinery room are, of necessity, extremely compact. Heating supply, return, and drip lines, city water supply line, pool recirculating piping system to the pumps and filters, drainage system, vacuum cleaner lines, together with the various electric circuits, constitute a veritable network of piping. Connecting to the machinery room, which is at the west end of the pool, on the south and east ends of the pool, pipe tunnels have been built, through which the various distributing lines are run. On the north side, the piping is built into the wall construction.

For conservation of space, a ladder located at the north wall leads from the lower level to the highest piping and valve nests in the machinery room. Removable gratings are arranged at the main floor level for accessibility to the pumps, and for ventilation of the lower level and pipe tunnels.

In the main floor portion of the machinery room, filtration, sterilization, and heating equipment have

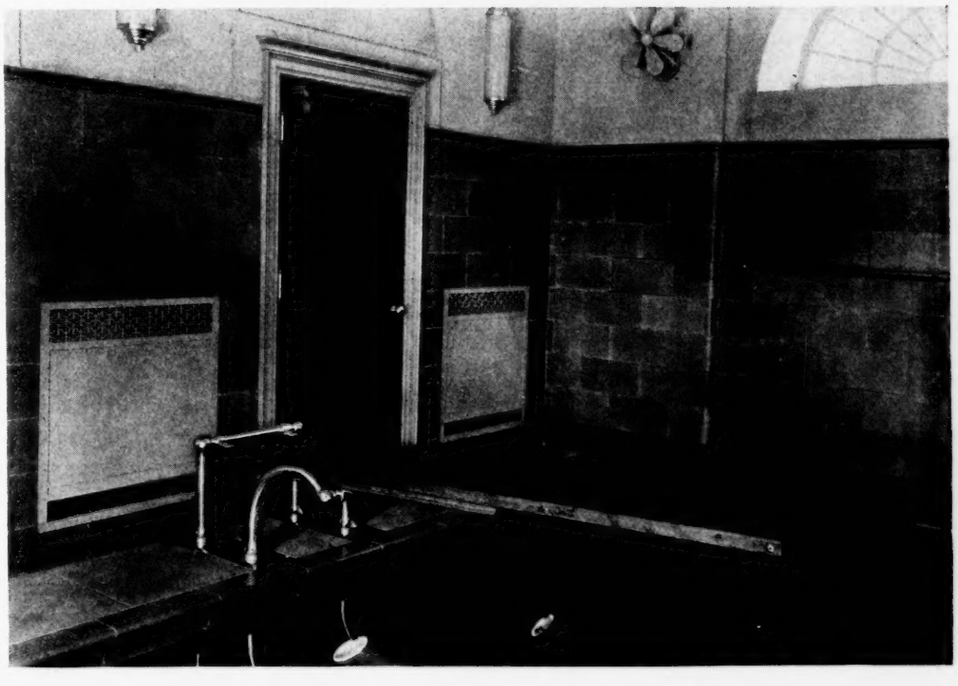


Fig. 2. Close-up of the diving board showing concealed radiators, scum gutter, pool inlets, and underwater lights.

been installed, plugged tees having been left in the piping for future adding of equipment.

The filter unit is arranged with wash water distributing and wash water overflow piping in the top. The filtering material used is made up of seven different grades of silica, especially selected, and ranging from the largest size, at the bottom, to the finest, at the top.

For the proper coagulation of the water before filtration, the filter is equipped with two chemical feeders, one for alum and the other for soda ash. These feeders are connected to automatic differential proportioning and introducing devices, so as to feed the reagents in direct proportion to the rate of flow of water through the filter. The alum feeder is built of 96% copper alloy, and the soda ash feeder is built of steel.

The filter is equipped with a device for indicating the rate of filtration during service, and the rate of flow when backwashing. An automatic relief valve is provided at the top of the filter to prevent air binding. A sight glass is installed in the waste line for observing the condition of the waste water, when washing the filter. Rewash piping is provided for discharging clear filtered water into the pool. The rewash line is also provided with a sight glass for observing the condition of the filtered water prior to discharging it back into the pool. The filter is equipped with pressure gauges for indicating the incoming water pressure and the pressure or loss of head through the filter, so as to determine when backwashing is necessary. Sampling bibbs are provided for drawing samples of the raw or unfiltered water, and the filtered water.

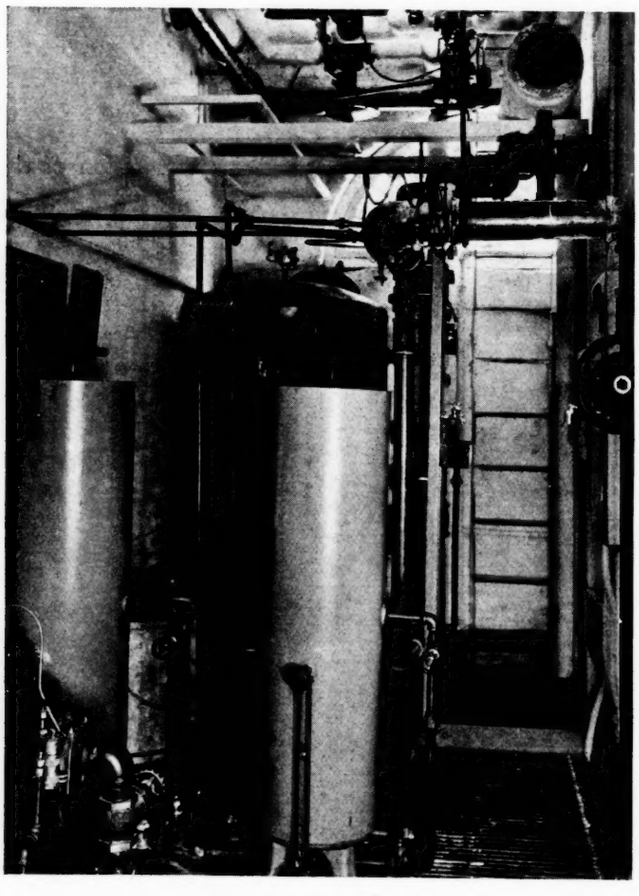


Fig. 3. Machinery room showing sterilizer in left foreground, chemical feeders, and filter. Above is the instantaneous water heater, and various control valves.

The rate of flow indicator, pressure gauges, and sampling bibbs, are mounted on a black enameled steel gauge board, with sink attached for catching any spillage of water when drawing samples of the filtered or unfiltered water.

By-passes have been provided in the city, or raw water piping, for washing the filter direct, either with city water or water directly from the pool, at the operator's option, the same gauges being used.

For fast filling of the pool, city water is passed directly through the heater for tempering, but by-passing the filter and sterilizer. After filling with city water, recirculation is started from the pool through the 55-gal. pump, filter, heater, and sterilizer in the order named, water being pumped from the deep end and discharged back at the shallow end. A hair-catcher has been inserted in the piping between the pool and the pumps, for catching lint from bathing suits, and hairs.

From point of entrance at the lower level, the high-pressure steam line is carried vertically to its highest point in the machinery room, this line being dripped at its base through an air release bucket trap, with an automatic air by-pass. Condensation after being discharged from this trap is lifted 6 in. to the level of the return main. The heater supply line is taken directly from the high-pressure steam main—the pressure varying between 20 lb. and 35 lb. For supplying the heating system, a double-seated pressure reducing valve was installed. Pressure gauges with 6-in. dials have been placed on both sides of the reducing valve, with a safety or relief valve on the low-pressure side, set at 10 lb.

After the water discharges from the filter, and before entering the pool, it is passed through an instantaneous type steam water heater for the purpose of raising the temperature to any desired degree. Water from the pool circulates through the copper tubes which are surrounded by steam in the body of the heater. A capacity of 6450 gal. hourly, based on a 60° rise, with steam at 20 lb., can be had. Control of the water temperature is effected by two thermostatic type diaphragm-actuated regulators, a 2½-in. operating when the pool is being filled or a considerable amount of quick heating (by-passing the filter) is required. A 1½-in. valve is used when circulating through the filter. In both cases the thermostatic sensitive bulb elements are inserted in the water line entering the heater, through which city water or recirculated pool water flows, at the operator's option. Both valves are entirely automatic.

Condensation from the instantaneous heater is handled by a combination float and thermostatic trap, arranged to handle quickly the large quantities of water occasioned by quick heating, thereby freeing the heater from condensation at all times. This trap is fitted with a thermostatic by-pass.

In addition to clarification of the water by filtration, the recirculated filtered water is sterilized before entering the pool so that only clean, clear, sterile water of the desired temperature is discharged into and maintained in the pool. The sterilizing apparatus automat-

ically proportions a predetermined amount of sterilizing solution to the recirculated water as it passes from the filter to the pool. The proportioning device is actuated by an accurate water meter, causing the rate of application of the sterilizing agent automatically to increase with a changing recirculation rate, and automatic starting and stopping with the flow of water through the system. The pool water is not only sterilized as it recirculates, but also contains an available sterilizing residual which, by its presence in the pool itself, would serve to counteract any infection that might be introduced from outside sources.

Piping, valves, and fittings used throughout the filtration and recirculating system are 85% copper alloy. Each valve is tagged and charted for proper location and operation. The valves on the filter are, in addition, equipped with name plates, specifying the particular function of each, these functions being set forth on a framed set of operating instructions.

Particular attention was paid to the drainage of the pool itself, the surrounding walkway, the dressing rooms, and the showers. Two 4-in. angle type outlets were used at the bottom and discharge end of the pool at the deepest portion. Arranged around the pool at regular intervals are 12 scum gutter drains, connected directly to the sewer. Eight pool inlets, all individually valved to permit accurate distribution, are installed just below the water line of the pool. The deck around the pool is graded slightly away from the edge, towards a series of floor drains. Each dressing room and shower bath is separately drained.

The only visible evidences of the room heating system are the grilles through which the warm air enters. Radiators of the concealed type were built into the walls of the rooms. These radiators are of copper and brass construction, the enclosures being of the removable type. A metal panel covers the entire radiator recess, a feature being its construction in two sections, the lower of which, when removed, provides easy access to the radiator valve and trap, or removal of the entire radiator, if necessary.

All radiator runouts are doubly controlled, a gate valve being installed in the pipe tunnel close to the supply or return main, with a second valve at the radiator for adjustment at that point. Also each radiator enclosure is provided with a damper for the purpose of varying the heat supply. This damper may be set in any position, and is knob-operated.

All of the radiators in the swimming pool room are fitted with key-adjusted regulating fittings of the orifice type, the purpose being to provide a means of balancing the steam supply so that it will flow to the various radiators in proper proportion, and at substantially the same time. These fittings can be adjusted to any desired rate of steam flow after the installation is fully completed and while the system is in operation. The return ends of all radiators are equipped with thermostatic traps. Ends of mains are fitted with float and thermostatic traps, strainers, and cut-off valves.

Heating lines throughout are insulated with 85% magnesia sectional pipe covering, of double thickness with waterproof wrapping on the outside underground lines. All lines in the machinery room are canvassed and stitched, in some cases galvanized iron forming a further protection over the insulation.

Acme

Fig. 4. President Roosevelt congratulating engineers and builders of the swimming pool on their fine job.

Four of the French door openings at the south side of the swimming room contain capped radiator runouts in boxes with chromium-plated covers set flush with the door sills. These outlets are designed for installation of additional radiation if required.

As to the shower baths, mixometer-controlled shower and needle baths were installed. Side spray heads and an angle overhead shower are used with controls arranged to permit operation of either or both at the pressure desired. There is a short nozzle placed 6 in. above the floor of each shower stall for testing the water temperature with the foot. Various accessories used in the dressing rooms include towel baskets, shelves, towel pins, and racks, tumbler holders and medicine cabinets, all of solid brass.

In the pool room there is set an indicating thermometer with direct reading from 30° to 120°. The bulb for this is in the discharge line from the bottom of the pool. The instrument is adjusted from a panel board in the machinery room. Operating current is supplied from a compensated air cell, a new type of battery recently developed. Temperature of the air, or of the wiring, has no effect upon the instrument itself. For the operators' convenience, a dial type thermometer has been set into the main supply to the tool, in the machinery room.

The project was handled under the direction of Major D. H. Gillete, Engineering Division of the Office of Public Buildings and Public Parks. The mechanical installation was made by the Reliance Engineering Co., Inc., of Washington, D. C., and Charlotte, N. C. General contractor was the James Baird Co., Washington. Pipe covering and insulation was done by Reid-Hayden, Inc., of Washington and Baltimore.

Calculation and Design of Mechanical Warm-Air Heating Systems

Part 2 (Conclusion)

By J. DONALD KROEKER†

[*The preceding article outlined step-by-step the procedure in designing a typical recirculating mechanical warm-air system as far as determining the air volumes and temperatures necessary.*]

TWELFTH. All the requisite information now being indicated on the basement plan, the duct sizes may be determined.

In general, the system is so planned that the resistance in any branch from a trunk line is equal to the resistance in the trunk from that point to the most remote outlet. Referring to Fig. 7, the resistance in the branch at h must equal that in the trunk from h to j; the resistance from a to c must equal that from a to j, and the branch from d to e must have the same resistance as the trunk from d to j, etc. Only in this way can a balanced air distributing system be designed.

Also, the simplest accurate method of sizing the trunk system is to use the same rate of friction[1] throughout the entire length of the main duct or trunk. This may be selected between 0.04 in. and 0.1 in. water column[2] per 100 ft. of duct for residences. One method of determining this rate is to select a velocity from Table 1 for the most remote section of the trunk, calculating the rate of friction for this section, and then using this rate for the entire trunk.

It will be found that, by designing for equal friction, the velocities in the larger sections of the trunk (those nearer the furnace) will be considerably higher than those near the ends of the trunk. This is ideal practice[3].

A rate of friction selected arbitrarily from experience or from the velocity in the most remote section of the trunk must be such that the maximum velocity, which will, as a rule, occur in the largest duct, does not exceed 1100 f.p.m., except in industrial installations. Air noise is almost certain to occur at velocities above this figure.

For the example following a friction of 0.08 *in. water column is used, and round pipe will be used for branches, wherever practicable.*

All calculations for duct size will be made by means of the Friction Chart, Fig. 9.[4] Scale 3 on this chart reads friction per 100 ft., in inches water column; scale 4 reads velocity; scale 5, air volume, and scale 6, diameter of round ducts.

Example of Use: To determine the size of the round pipe from h to j in Fig. 7, align 75,[5] the amount of air to be carried, on scale 5 with 0.08 on scale 3, and find on scale 6 a pipe having a diameter of a little less than 6 in. Since fractional sizes are not used, a 6-in. pipe will be installed and is specified.

Section g to h is to carry 118 c.f.m. Align 0.118 on scale 5 with 0.08 on scale 3, and find on scale 6 a diameter a little less than 7 in. However, a rectangular duct is to be used here. Scales 7 and 8 give sizes of rectangular ducts which have the same rates of friction as round pipes given on scale 6. So, holding (with pencil point or pin) the point obtained above on scale 6, set the straight-edge on the desired depth of the duct on scale 8 and read the width on scale 7. Thus, if a 6-in. depth is desired, a width a little less than 7 in. is necessary, and a 7 in. × 6 in. duct is used. Similarly, for section f to g, which is to carry 251 c.f.m., an 11 in. × 6 in. duct is used.

This same method is now pursued in designing the rest of the trunk system from the furnace. Scale 5 is *fully accurate,* when used in this way, only for round ducts[6]. For fully accurate use of this chart on rectangular ducts, the circular equivalents as obtained from scales 7 and 8 on scale 6 must be aligned with velocity on scale 4 to obtain rate of friction on scale 3.[7]

Now the resistance in the trunk to various branches

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†Montag Stove & Furnace Works, Portland, Ore.

[1] "Friction" and "resistance" are two terms usually applied to the same thing; namely, the resistance to flow of air owing to friction (by rubbing, turbulence, etc.) between the moving air and the surface against which it moves. As applied here, "friction" is rate of resistance and "resistance" is the resistance offered by any part of a system. "Static pressure" is the pressure required to cause a certain volume of air to flow against a certain resistance.

[2] "Inch water column" is an expression for pressure and is the amount of pressure exerted by a water column 1 in. in height or the pressure due to a difference in water level of 1 in. It is equal to 0.036 lb. per sq. in. or 0.579 oz. per sq. in.

[3] Energy of two kinds is imparted to the air by the blower in a mechanical warm-air system; namely, potential energy, also called static energy, and kinetic energy or energy of motion. Static pressure is a measure of the static energy, and velocity pressure (which might be compared to wind pressure) is a measure of the kinetic energy. As the velocity of an air stream is decreased by means of increasing cross-sectional area, the kinetic energy is converted into potential energy or results in an increase in static pressure. So as the air progresses along the trunk from the furnace, it is desirable to convert some of the kinetic energy to static for greater efficiency in distribution. This is done by decreasing velocities as the distance from the furnace increases.

[4] These friction charts are strictly accurate only for standard air, 70° 29.92 in. mercury column. Friction varying directly as the density and inversely as the absolute temperature, these charts are correct only at sea level for temperatures usually encountered in heating and ventilating work, and are approximately 3% high at 1000 ft. elevation, 8% at 2000, 12% at 3000, 16% at 4000, and 20% at 5000 ft.

[5] Note that Scale 5 is in terms of 1000 c.f.m. Therefore, our 75 c.f.m. is found at 0.075 on Scale 5.

[6] Very nearly accurate results will be obtained also for rectangular ducts if the widths are obtained as above to the nearest inch up to 20 in. wide, taken as 1 in. less than obtained as above for ducts 20 in. to 30 in. wide, and 2 in. less for ducts wider than 30 in.

[7] For a thorough discussion of this fully accurate use of friction charts in designing systems having rectangular ducts, see HEATING AND VENTILATING, May, 1932.

must be determined. When using straight pipe or ducts, scales 1, 2 and 3 are used directly. For example, if a duct in which the friction is 0.08 is 27 ft. long, its resistance will be found by aligning 27 on scale 1 and 0.08 on scale 3 and finding on scale 2 the figure 0.0215.

If the duct includes 90° elbows, the length of straight pipe which will have the same resistance as the elbows may be determined by means of scales 9, 10, and 11. For example, if the throat radius of a given ell is 10 in. and its width or diameter is 15 in., align 10 on scale 10 with 15 on scale 9 to obtain the length of straight duct having the same resistance on scale 11; namely, 24 ft. Had this been a 45° ell, its equivalent length would have been just half as great, or 12 ft. Thus, if the above 27 ft. of straight pipe had included a 90° ell having an equivalent length of 24 ft., as obtained above, the total equivalent length of the duct would have been 51 ft. Lining up 51 on scale 1 with 0.08 on scale 2 we find on scale 3 the total resistance of 0.041 in. water column.

Returning to the example in Fig. 7, the section h to j is 10 ft. long, has two 45° ells, and one 90° ell (at the foot of the riser). Each ell has a throat radius of 4 in., and the equivalent length of this section is 10 plus 7 plus 7 plus 14, or 38 ft. The resistance of this section is found to be 0.030. The equivalent length of section g to j is 40 ft. and the resistance 0.032; f to j, 42 ft. and the resistance is 0.034; etc. The equivalent length to the furnace, when the throat radius of the 25 in. $\times$ 8 in. duct is 25 in., is 86 ft. and the resistance is 0.068.

Now indicate at each branch the amount of resistance in the trunk to that branch, as in Fig. 7. Each branch must be designed to equal the resistance indicated.

The branch at h is to have a resistance of 0.030, equal to that through hj.[8] Its length is 2 ft. and the equivalent length of a 90° ell having a throat radius equal to its width will be approximately 10 ft. So the total equivalent length of the connection to this wall register will be 12 ft. Aligning 12 ft. on scale 1 with 0.030 on scale 2 gives a rate of friction on scale 3 of 0.25 in. per 100 ft. This is the rate of friction for which the connection or branch is to be designed. Now proceed as in designing the trunk—align 0.25 on scale 3 with 0.043 (the volume of air to be carried by this branch is 43) on scale 5, to read a 4-in. pipe on scale 6.

The branch at g is composed of a 90° ell at the trunk, a straight piece of pipe, a 90° ell at the riser, and the riser. Due to the fact that warm air rises by gravity, the resistance in a straight riser to the second or third floor is negligible unless the velocity in it exceeds 500 f.p.m.[9] If this resistance were not negligible, it would have to be calculated and the velocity figures used would be the actual velocity less 300, or in this case, 160 f.p.m. This resistance would then have to be subtracted from that for the branch; namely, 0.032, and then the procedure would be as above, or as follows: Equivalent length is 2 ft. plus 10 plus 10, or 22 ft., and the rate of friction (again aligning scales 1, 2 and 3 with 0.032 on scale 2[10]) is 0.145. Aligning this on scale 3 with 0.133 (133 are the c.f.m.) on scale 5, a 7-in. pipe is read on scale 6.

The remainder of the branches are sized in the same way as the two described.

The method of sizing the cold-air system is similar in every respect to that used in designing the warm-air ducts. Transition fittings and long-radius elbows are just as important in the return half of the entire system as in the warm or conditioned air side, and the resistance must be calculated for them in the same way.

When a cold-air duct running across joists collects air from boxed or enclosed joists, and the opening in the top of the duct is made large enough so that the velocity in the opening is less than 150 f.p.m., the resistance in the connection may be considered negligible. If the velocity is greater than 150 f.p.m., the resistance must be calculated.

[8]The resistance through each branch beyond their junction must be designed as equal. Otherwise the air volume will adjust itself to make it so, for if one path sets up less resistance, more air will follow that path.

[9]From the University of Illinois Bulletin No. 141, 1 sq. in. of leader pipe area or 0.7 sq. in. of riser area will carry 100 B.t.u. per hr. of 140° air to the second floor. This is a volume of 1 c.f.m. and a velocity of 266 f.p.m. Air rising at this rate overcomes the resistance in the riser by gravity and no pressure is required. However, pressure is required to cause air of this temperature to flow against resistance due to a velocity greater than this. In the above example, where the velocity is 466, the added velocity for which pressure must be applied is 466 less 266 or 200 f.p.m. According to the friction chart, this corresponds to a resistance of 0.002 in. water column, which may be considered negligible.

[10]In this case no subtraction is made, since the lessened resistance is negligible.

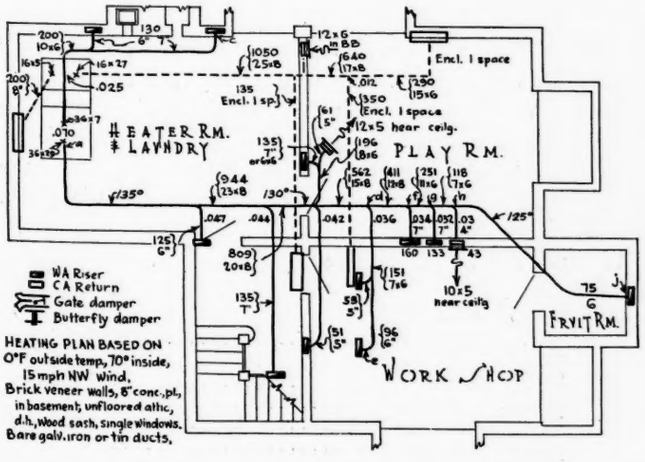
HEATER RM. & LAUNDRY
PLAY RM.
WORK SHOP
FRUIT RM.
Encl. 1 space
12x5 near ceilg.
WA Riser
CA Return
Gate damper
Butterfly damper
HEATING PLAN BASED ON 0°F outside temp., 70° inside, 15 mph NW Wind, Brick veneer walls, 8" conc. pl. in basement, unfloored attic, d.h., Wood sash, single windows. Bare galv. iron or tin ducts.

Fig. 7. Skeleton layout of duct system in basement

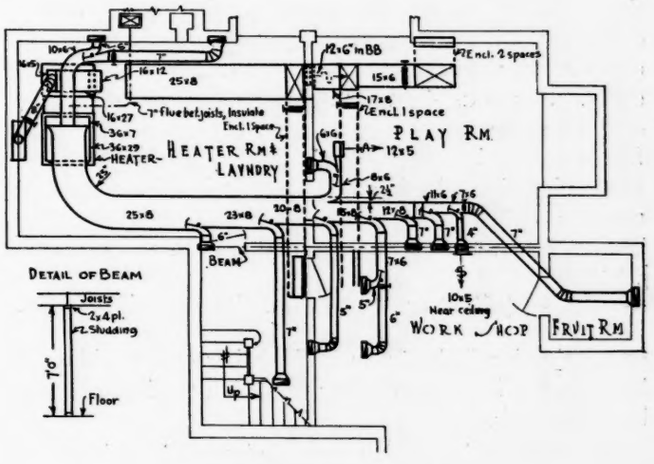

Fig. 8. Finished layout to scale

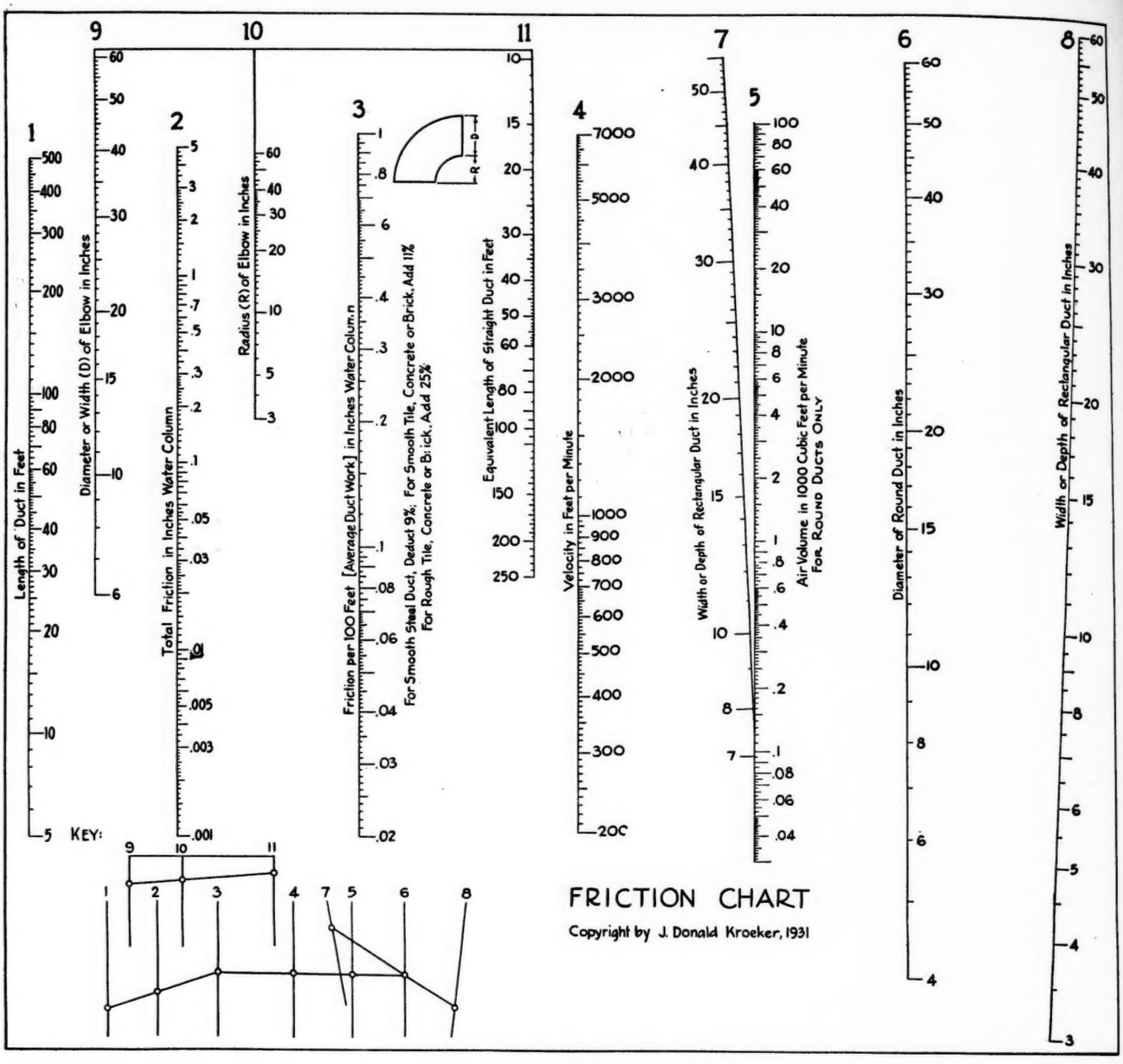
1
2
3
4
5
6
7
8
9
10
11
Length of Duct in Feet
Diameter or Width (D) of Elbow in Inches
Radius (R) of Elbow in Inches
Total Friction in Inches Water Column
Friction per 100 Feet [Average Duct Work] in Inches Water Column
For Smooth Steel Duct, Deduct 9%; For Smooth Tile, Concrete or Brick, Add 11%
For Rough Tile, Concrete or Brick, Add 25%
Equivalent Length of Straight Duct in Feet
Velocity in Feet per Minute
Width or Depth of Rectangular Duct in Inches
Air Volume in 1000 Cubic Feet per Minute
For Round Ducts Only
Diameter of Round Duct in Inches
Width or Depth of Rectangular Duct in Inches
KEY:
FRICTION CHART
Copyright by J. Donald Kroeker, 1931

Fig. 9. Friction chart for solution of duct sizes

Always show or specify transition connections from the furnace to the warm-air ducts and from the return ducts to the blower casing. Proportion the sizes of the connections according to the volumes of air they must carry. For example, the furnace in Fig. 7 is 40 in. × 40 in. and the over-all size of the connection from the furnace is to be 36 in. × 36 in. A total volume of 1329 c.f.m. is to be handled, 1069 c.f.m. by the main trunk, and 260 c.f.m. by the duct to the living room. The area of the outlet to the main trunk will then be

$$\frac{36 \times 36}{1329} \times 1069 \text{ or } 1040 \text{ sq. in.}$$

The width is 36 in. so the depth will be 29 in. The other outlet will then be 36 in. × 7 in. Similarly proportion the inlets to the blower casing.

The skeleton layout is now complete and the installation can be made from it, although it will be found that time, labor, and material will be saved by making a drawing of the layout to scale as in Fig. 8.

THIRTEENTH. Total resistance in the system may now be determined. The summary for the example layout used is shown in the lower left corner of the sample data sheet. The resistance through registers may be taken from the following table, in which the velocity through the free area of the register is given.

Resistance through filters, furnaces, etc., may be taken from the manufacturers' catalogs.

Velocity (f.p.m.)	Resistance (in. water col.)
250	0.006
300	0.008
350	0.011
400	0.014
500	0.022
600	0.032
700	0.043
800	0.057

FOURTEENTH. Compute the heat required or the amount of heat which must be supplied by the furnace from the formula

$$H = 60 \times C_p \times \text{c.f.m.} \ (t_b - t_i),$$

where H is the heat output capacity of the furnace in B.t.u. per hour, C_p is the specific heat of air in B.t.u. per cubic feet per hour, t_b is the bonnet temperature or the temperature of the air leaving the furnace, in °F., and t_i is the temperature of the air entering the blower. C.f.m. is the total volume of air to be supplied to the blower and is obtained for this formula by totalling column 13. (See Data Sheet, Part 1 of this article).

The solution of this formula for the example given is

$$H = 60 \times 0.0185 \times 1329 \ (140 - 65) = 110{,}000 \text{ B.t.u. per hr.}$$

FIFTEENTH. Knowing the total resistance of the system and the air volume and heat to be supplied, select the mechanical equipment to be used and indicate it on the data sheet.

SIXTEENTH. Make another tracing of the basement plan and draw in to scale all equipment, piping, and fixtures which are to be specified. Show locations and types of all dampers.[11] Include a note stating the temperature and construction on which the layout is based and another explaining the symbols used. The title of this drawing must show the name of the client, date, scale of the drawing, and signature.

Systems of Mechanical Warm-Air Heating

A few of the different systems of mechanical warm-air heating, chiefly as applied to warm-air furnaces, are briefly described in the following. No attempt is made to include descriptions of all of the many systems in use, many of which differ in only a few minor details, but those most common, especially in comparatively small installations, are shown and the computations required to determine heating capacity are given. In each group many variations of accessory and control equipment are possible.

No. 1. *Recirculation.* This is the system used in the example under Procedure of Design, in which the computations necessary for determination of heating capacity are given in the Fourteenth step. An air washer, washer-humidifier, dehumidifier, filters, and ozonators may be used with this arrangement. Fan operation is intermittent at the command either of the room thermostat and in series with the bonnet motor control and the automatic fuel control or of the bonnet control only. The former is preferable for the prevention of "cold 70."

No. 2. *Outside Air Circulation.* All air used in this system is drawn from outside the building, but constant ventilation is not required. Humidifying or washing must be done on or after the furnace, so evaporator or fog type humidifiers are adaptable. Motor operation is intermittent and in series with operation of the fuel control and the bonnet motor control. Filters and ozonators may also be used as in System No. 1. The heat output capacity of the heater is calculated from

$$H = 60 \ C_p \ (t_b - t_o) \text{ c.f.m.}$$

where H is the heat output capacity in B.t.u. per hour,
t_b is the bonnet or duct temperature in °F., and
t_o is the temperature of the outside air in °F.

Example: Using the figures in example installation and assuming the values 0° and 140° for t_o and t_b, respectively,

$$H = 60 \times 0.0185 \times (140 - 0) \ 1329 = 216{,}000 \text{ B.t.u. per hr.}$$

This may be computed also by means of the Air Volume Chart by factoring. Thus, align 70° (½ of 140) on the left-hand scale and 133 c.f.m. (1/10 of 1329) on the right-hand scale and read 10,300 B.t.u. per hr. on the middle scale, which will be 1/20 of the desired result, from which H = 206,000 B.t.u. per hr.

No. 3. *Combination of Recirculated and Outside Air.* This is used if the ventilation requirements are small but constant. It is necessary to recirculate some air in order to prevent excessively high bonnet temperatures. Fan operation is continuous and low and high limit controls are installed in the bonnet or in the warm-air stream near the furnace. Accessory equipment used in System No. 2 may also be applied here.

Example: If the requirements are for 500 c.f.m. of outside air and the bonnet temperature is specified at 140° the damper is set to recirculate all but 500 c.f.m. The heat output capacity required of the heater will be

$$H = 60 \ C_p \ [\text{c.f.m.}_o \ (t_b - t_o) + \text{c.f.m.}_r)(t_b - t_r)] \ \ldots\ldots (1)$$
$$\text{or } H = 60 \ C_p \ \text{c.f.m.}_o \ (t_b - t_o) + 60 \ C_p \ \text{c.f.m.}_r \ (t_b - t_r) \ \ldots\ldots (2)$$

Substituting the values in the example,

$$H = 138{,}400 \text{ B.t.u. per hr.}$$

Equation (2) may be solved in two parts by means of the Air Volume Chart and the parts then added; thus,

$$H = 77{,}800 + 60{,}600 = 138{,}400 \text{ B.t.u. per hr.}$$

No. 4. *Outside Air, Constant Volume for Ventilation.* Fan operation is continuous and air is mixed from tempered air and warm or conditioned air chambers at the command of a room thermostat. The mixing may be done at the risers, in which case two air moving systems are required, or at the furnace, a separate duct leading from the heater to each riser. Evaporator or fog type humidifiers installed on or after the furnace, filters, and ozonators may also be used with this system.

[11] If a system were accurately designed to fractional parts of inches in the duct sizes, according to this article, and installed precisely in accordance with this design, no dampers would be required or, if installed, might be left in their neutral positions. However, since it is the practice to specify duct sizes in whole numbers and since the designer can not know for certain that the installation will follow his design in every detail, he must specify dampers. These must be located to admit adjustment of air volume to all warm-air outlets and return-air intakes, except those farthest from the furnace or those obviously having the greatest resistance. All dampers should be supplied with locking quadrants.

Gas-Heated Atlanta Building Gives Unit Fuel Data for Southern Climate

W. W. Orr Doctors' Building, Atlanta, Ga.

By RAYMOND C. BROACH†

DURING 1930-31 the W. W. Orr Doctors' Building was built to provide Atlanta physicians and surgeons with the most modern office building possible, as well as a center where special requirements of their profession were given prime consideration. The building is 11 stories in height with an available floor space of approximately 115,000 sq. ft., and is located just out of the congested business district of the city, on Peachtree Street. A garage for the convenience of both doctors and patients is included as a part of the plant. In addition, there are prescription shops, a coffee shop and soda fountain, a barber shop, and several branch offices of manufacturers who build and service medical equipment. Building service includes the circulation of both hot and refrigerated water to each office.

Much thought was given to the heating system also. It was finally decided that a differential heating system operating as a single zone, under thermostatic control, would be installed. The garage and three stores adjoining the main building, all one story in height, were to be supplied with steam at boiler pressure independently of the automatic differential system.

The record low temperature for Atlanta is —8°. The heating system was designed for a 70° maximum difference between outside and inside temperatures. The required radiator surface in square feet is distributed as follows:

First to eleventh floors, inclusive	13,350
Basement	70
Stores	1,250
Garage	2,318
Steam coil water heater	2,200
Total	19,188

†Heating engineer, Atlanta Gas Light Company, Atlanta, Ga.

Originally it was intended to burn coal on mechanical stokers. While plans were developing natural gas was being introduced in Atlanta fom the fields of northern Louisiana. After careful consideration the plans were altered to include natural-gas-burning equipment for building heating, water heating, and incineration. Even though this decision was made, the coal storage space and means for handling coal and ashes were left in the final design.

Two welded steel low-pressure heating boilers, each having 1025 sq. ft. of heating surface, and two 500-gal. per hr. multi-coil storage water heaters were installed. The gas burners in the two main heating boilers are controlled by a steam pressure limit control, a low water fuel cut-out, and automatic pilots, and require no supervision except in starting and shutting down. A gas-fired incinerator is also a part of the boiler room equipment. The building engineer and his night assistant give all the supervision to the boiler plant that is necessary.

Gas meters were so installed that gas consumption for each service could be easily segregated. These various services are (1) building heating, (2) water heating, and (3) usage by tenants. It has been found that the gas consumption for incineration is a negligible quantity since dry paper makes up a large part of the total refuse.

The building was completed and occupied in June, 1931. By use of the tables and graphs that follow, the fuel consumption for the various services for two 12-month periods, beginning with July 2, 1931, is shown. Usage by tenants is shown as a constant quantity throughout since so little variation occurred from month

to month. Gas used by the incinerator was so slight as to be neglected entirely.

Throughout the two one-year periods the percentage of building occupancy has remained practically constant at 90%. Radiators in all vacant space have been disconnected. Except for November, 1931, steam heat has not been furnished to the garage. Consequently, the heating load served by the main heating boilers, for the basis of this study, is made up as follows:

First to eleventh floors inclusive.....13,350 × 0.90	= 12,000 sq. ft.
Basement	70 sq. ft.
Stores	1,250 sq. ft.
Total	13,320 sq. ft.

The heating system was designed to provide higher temperatures than are required in the average office building. Many of the doctors in the building actually maintained temperatures from 75° to 80°, whereas 70° to 72° was the average temperature in other parts of the building.

In Fig. 1 the curve showing gas consumption per square foot of required radiation per degree-day is unbalanced at the third monthly period because of steam supplied to the garage during this period only, and further, because of necessary tests and adjustments on the burning equipment. It will be observed that for other months of the season this curve varies in opposition to the degree-day curve in a manner that is fairly consistent. This is even more apparent in Fig. 2, which represents the second year's operation. As would be expected, the curve representing gas consumption by months follows very closely the curve representing total degree-days by months.

On Figs. 1 and 2 are curves indicating the total gas consumption by months for water heating. The variations in these curves are due largely to the variations in incoming water temperatures. Water main temperatures in Atlanta range from 45° to 80°, approximately.

Fig. 3 shows the daily record of degree-days, total gas consumption for building heating, and gas consumption per square foot of radiation per degree-day. This group of curves is for the period of February 2 to March 2, 1933. This period was selected because it contained the most varied weather conditions of any during the two years. It is very likely that the degree-day curve and the gas consumption curve would follow each other more closely and the curve indicating gas consumption per degree-day per square foot of radiation would vary in more marked opposition to the first two but for two factors: (1) changing wind velocities and degrees of cloudiness which are not factors in degree-day determinations, and (2) meter readings that covered from 21 hr. to 27 hr. per day instead of exactly 24 hr. Since building operations are reduced on Sundays these days are indicated.

Regular checks made of the plant operation have consistently indicated an overall boiler and furnace efficiency of about 80%. Each boiler was set to operate at full capacity of about 100 boiler hp. The burner action has been full-on and full-off. One boiler has

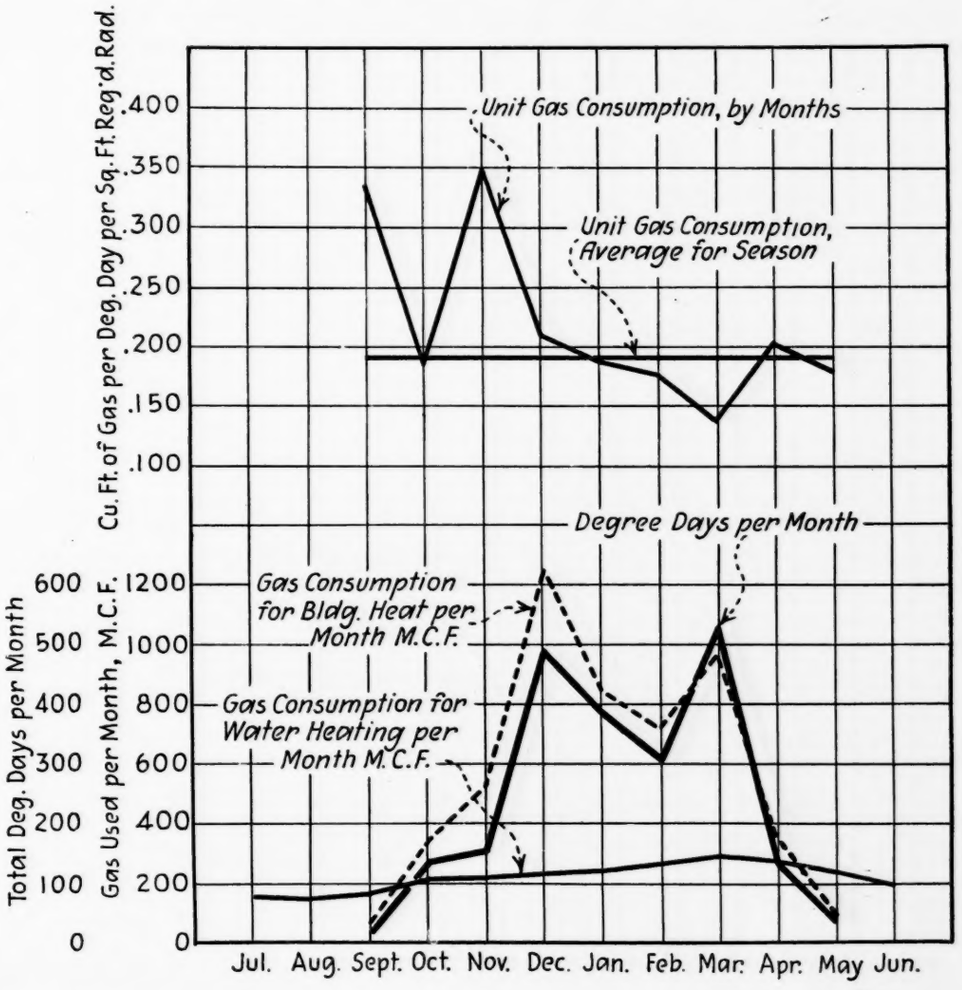

Fig. 1. Gas consumption data for the W. W. Orr Doctors' Building for the heating season of 1931-32. The peak in the upper curve in November was due to the fact that the garage was served with steam only during that month.

(The data by months from which these charts were made were not strictly calendar months but monthly billing periods which in most cases ran from the 2nd of the month to the 2nd of the following month.)

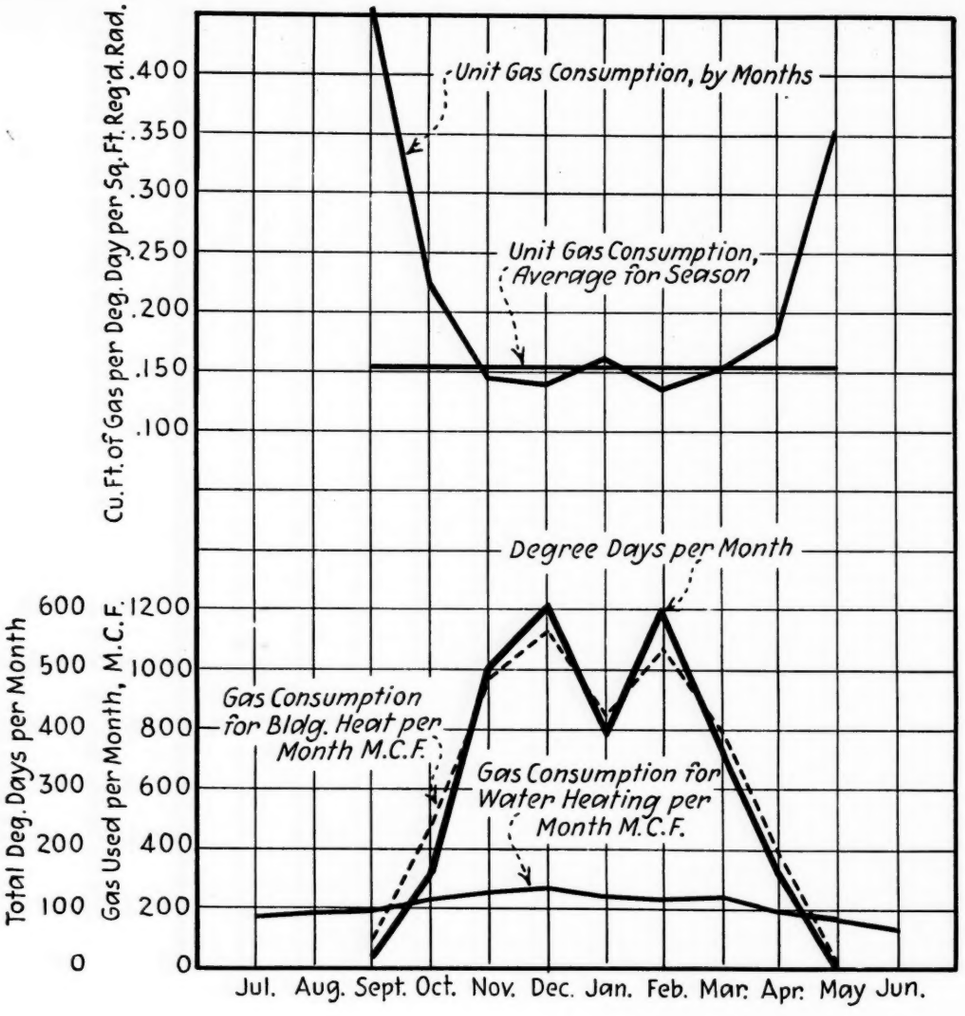

Fig. 2. Gas consumption data for the W. W. Orr Doctors' Building for the heating season of 1932-33.

(The data by months from which these charts were made were not strictly calendar months but monthly billing periods which in most cases ran from the 2nd of the month to the 2nd of the following month.)

carried the full load except during the most extreme weather when both were operated. Check tests showed the flue gases to contain about 9% CO_2 and no CO. The flue gas temperatures reached a maximum of approximately 325°. No carbon deposits of any kind have been in evidence since the first adjustments were completed.

It will be observed that the gas consumption per degree-day per square foot of required radiation was 0.191 cu. ft. for the season of 1931-32 and 0.155 cu. ft. for 1932-33. The degree-day total in Atlanta for 1931-32 was 2173 and for 1932-33 the total was 2811. The 42-year average total for Atlanta is 2880.[1]

It is becoming general practice more and more to estimate fuel consumption and to analyse it on the basis of the degree-day, a unit originated in the American Gas Association. Up to the present time no other method so generally acceptable has been advanced. Most of the published data from which estimating is done has been based on a yearly degree-day total of approximately 5500. When this data is applied to localities where the degree-day total is materially different incorrect results will follow unless the differences are compensated for. Whereas for an annual degree-day total of 5500 the gas consumption (1000 B.t.u. per cu. ft.) per square foot per degree-day is approximately 0.110 cu. ft., results at the W. W. Orr Doctors' Building in Atlanta indicate that 0.155 cu. ft. is approximately the correct value for an annual degree-day total of 2880. The writer suggests that in localities having milder and shorter winters this value should be correspondingly higher. Likewise, where the annual degree-day total is higher than 5500 the unit of gas consumption should be proportionately lower than 0.110 cu. ft.

Variations in this unit of gas consumption in different localities are due no doubt to the varying percentages of total time that the burning equipment operates. In Atlanta the hourly outside temperatures fluctuate over such a wide range that automatic non-throttling

[1]There is a slight disagreement between the author's records of degree-day totals and those kept by HEATING AND VENTILATING for Atlanta. Our records show 2165 for 1931-32, 2821 for 1932-33, and 2891 for the long-time average.—*Editor*

TABLE 1
FUEL DATA, SEASON 1931-32

Month Ending	Degree-Days	Gas Consumption, 1000 Cu. Ft. Space Heating	Water Heating	Tenants Usage	Total	Gas Used For Building Heating Per Degree-Day Total, M.C.F.	Per Sq. Ft. Rad'n. Cu. Ft.
1931							
Aug. 3	0	0	149.5	30	179.5	0	0
Sept. 2	0	0	141.8	30	171.8	0	0
Oct. 2	13	58.2	159.9	30	248.1	4.48	0 336
Nov. 3	134	329.8	210.6	30	570.4	2.46	0.185
Dec. 2	155	714.9	212.0	30	956.9	4.61	0.346
1932							
Jan. 4	488	1246.0	221.9	30	1497.9	2.79	0.210
Feb. 2	381	840.1	223.5	30	1093.6	2.50	0.188
Mar. 2	303	716.5	257.5	30	1004.0	2.36	0.177
Apr. 2	528	961.0	280.4	30	1271.4	1.82	0.137
May 3	132	353.1	264.1	30	647.2	2.68	0.201
June 2	39	94.3	237.5	30	361.8	2.42	0.182
July 2	0	0	191.4	30	221.4	0	0
Total	2173	5543.9	2320.1	360	8224.0	2.55	0.191

burners operate only from 20% to 25% of the total hours of the heating season. It would appear that the unit fuel consumption would approach more nearly the theoretical minimum the more nearly the burners operate 100% of the total hours in the heating season. In other words, there is a need for a compensating factor in the degree-day unit that would depend for its value on the annual degree-day total as well as the length of time over which it is distributed. The daily average degree-days for the season is perhaps the correct basis on which to begin. With the degree-day defined as at present as the basis of comparison, it is very likely that far different results would be found at San Francisco, where a nominal degree-day total occurs over a large number of months, from those encountered at Galveston, where a substantial total occurs in a relatively short period of time.

The decision to use gas at the W. W. Orr Doctors' Building was made with full opportunity to discontinue it if the experiment should have proved unsatisfactory or uneconomical. After two full years of experience from which complete cost records have been compiled the owners have found the service to be eminently satisfactory. Actual costs have been materially lower than the original estimates made by both the architects and the local gas company, who made the complete installation of the burning equipment. Costs of redecorating after two years have been remarkably low.

TABLE 2
FUEL DATA, SEASON 1932-33

Month Ending	Degree-Days	Gas Consumption, 1000 Cu. Ft.				Gas Used For Building Heating Per Degree-Day	
		Space Heating	Water Heating	Tenants Usage	Total	Total, M.C.F.	Per Sq. Ft. Rad'n, Cu. Ft.
1932							
Aug. 2	0	0	170.1	30	200.1	0	0
Sept. 2	0	0	183.8	30	213.8	0	0
Oct. 3	15	90.8	194.3	30	315.1	6.05	0.454
Nov. 2	159	475.6	225.3	30	730 9	3.00	0.225
Dec. 2	504	974.1	254.5	30	1258.6	1.93	0.145
1933							
Jan. 4	606	1129.4	268.8	30	1428.2	1.86	0.139
Feb. 2	396	857.3	240.5	30	1127.8	2.16	0.162
Mar. 2	599	1079.3	236.6	30	1345 9	1.80	0.135
Apr. 3	371	791.6	242.1	30	1063.7	2.14	0.153
May 2	156	384.3	199.3	30	613.6	2.46	0.184
June 2	5	23 4	165.4	30	218.8	4.70	0.352
July 3	0	0	135.4	30	165.4	0	0
Total	2811	5805.8	2516.1	360	8681.9	2.07	0.155

Simplicity and ease of operation and extreme cleanliness are intangible factors that contribute heavily toward making this one of the outstanding professional buildings of the entire country.

The W. W. Orr Doctors' Building is owned by the Marlborough Company. It is managed for the owners by the Adams-Cates Company. The architects were Pringle and Smith, and the consulting engineer was Robert S. Newcomb, all of Atlanta.

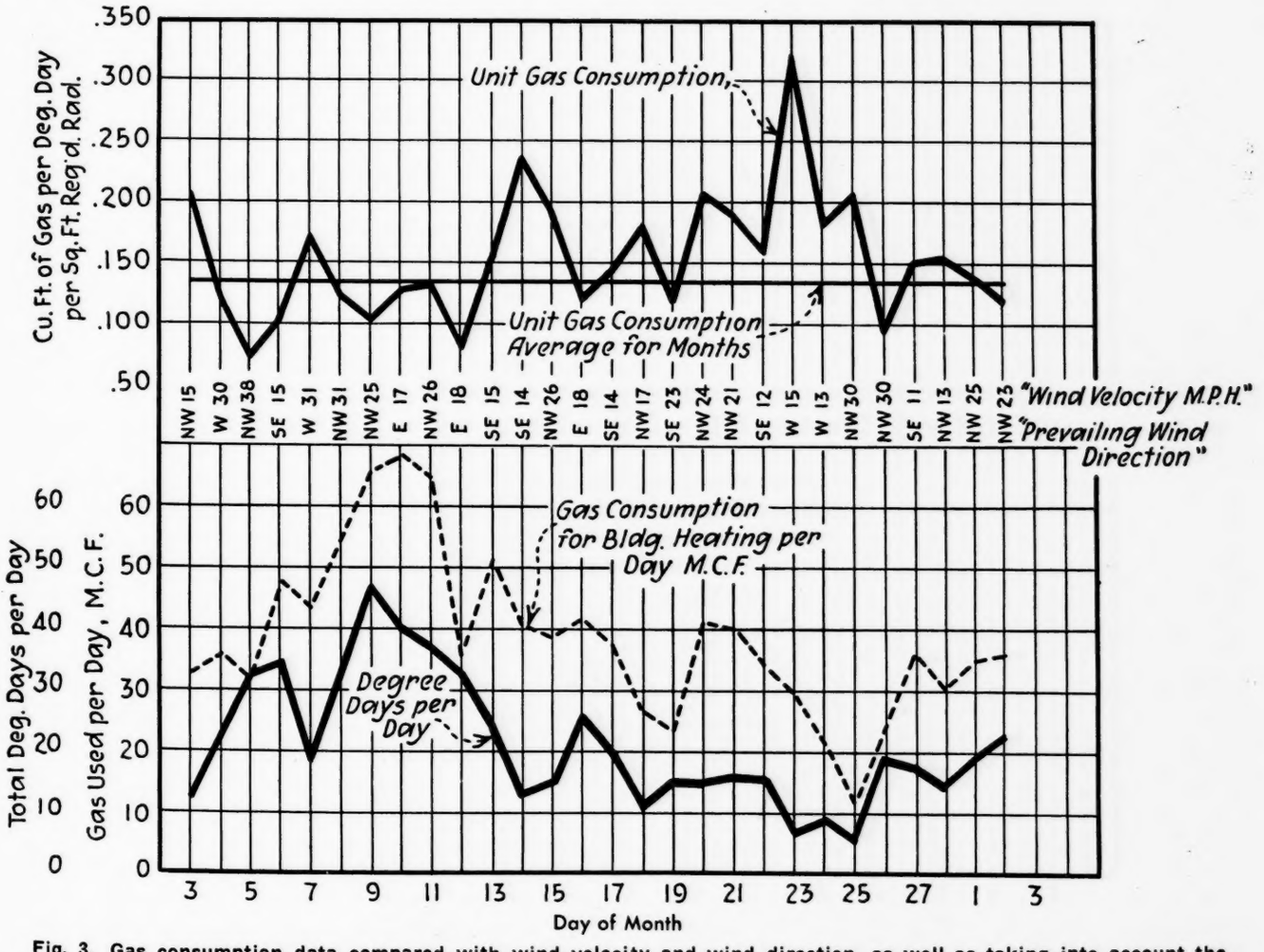
Cu. Ft. of Gas per Deg. Day per Sq. Ft. Req'd. Rad.
.350
.300
.250
.200
.150
.100
.50
Unit Gas Consumption,
Unit Gas Consumption Average for Months
NW 15 W 30 NW 38 SE 15 W 31 NW 31 NW 25 E 17 NW 26 E 18 SE 15 SE 14 NW 26 E 18 SE 14 NW 17 SE 23 NW 24 NW 21 SE 12 W 15 W 13 NW 30 NW 30 SE 11 NW 13 NW 25 NW 23
"Wind Velocity M.P.H."
"Prevailing Wind Direction"
Total Deg. Days per Day
Gas Used per Day, M.C.F.
60
50
40
30
20
10
0
Gas Consumption for Bldg. Heating per Day M.C.F.
Degree Days per Day
3 5 7 9 11 13 15 17 19 21 23 25 27 1 3
Day of Month

Fig. 3. Gas consumption data compared with wind velocity and wind direction, as well as taking into account the temperature variable. The period covered is from the 3rd of February to March 2, 1933.

More NRA Codes Appear

SPEED is the keynote of NRA. Move follows move so rapidly that one phase is no more than well under way before another comes along. This has been especially true during the last month. As things were just settling into an orderly and slow-moving process of getting codes drawn up and sent to Washington, the administration decided that the process was entirely too slow and orderly. The President's Re-employment Agreement (referred to as PRA in the recovery administration mimeographed releases) was drawn up. All employers of labor not under a code were asked to sign this. Its sudden injection into the picture changed the situation very markedly. A new movement and a whole new organization were immediately planned. The Blue Eagle came with it as an important feature. Attention to codes and to code hearings had to be sidetracked to some extent because the leaders were tied up with the agreement and with getting the organization started. This switch from code-drawing to the PRA and the Blue Eagle was the feature of the month's developments.

Some other important events took place, too. First of all, the interpretation to be put on the law by the administration was clarified and this helped to straighten out things in general. Next, the procedure was improved and it became possible to get information from NRA offices which had previously been swamped and without formal internal organization. Then more administrative help was secured and the various advisory boards got started. Finally, the increasing number of strikes caused the National Labor Board to be set up with representatives from industry, labor, and the public, and was charged with handling labor disputes. Thus, the machinery is being set up, oiled, and gotten ready to start grinding methodically.

Another event, or series of events, was the tendency toward strikes. The smouldering disputes in the coal and steel industries finally broke out into the open again. So, too, did those in many branches of textiles and their products. It became apparent that the organized unions recognized their opportunity to force recognition in industries where they had failed to secure it for years. The events of the month showed clearly that labor, and especially union labor, must be considered in the program. Codes drawn without consultation with labor may or may not get by the gauntlet. In the building industry, with the construction trades so strongly unionized, no one can yet predict events.

With the PRA plan came definite announcement that it was to apply to all employers without exception. This removed any doubts as to whether certain classes were exempt. It was made clear that the utility companies were expected to present a code. As a result the Edison Electrical Institute drew up a code for the electric light and power group, while American Gas Association acted for the manufactured gas utilities. The natural gas utilities filed a separate code. Contractors doing a local business were also included under the blanket provisions and thus any lingering doubts as to their status were removed. So, too, organized professional groups began to bestir themselves and the New York State Society of Professional Engineers appointed a committee to go into the matter.

Last month we mentioned that there was a tendency discernable to persuade many small groups to merge their interests into one large group. This tendency still continues, especially on the sales and construction side. It is less marked among the manufacturers who seem to feel positively that their problems are such that merging is not practical.

Determined moves are likely to be made to bring together all groups interested in the construction of buildings and get them to consent to one comprehensive code. If such a plan were adopted, heating, ventilating, and air conditioning would be included. This will be worth watching. It would simplify coordination of the codes but would make some one group all-powerful over the whole industry. There is much jealousy among existing trade associations and it is doubtful if they will pull together harmoniously in as large a grouping as would be required under this plan. Nevertheless, the attempt will be made and is likely to get going seriously, if at all, within the next few weeks.

Two such moves are under way and codes have been sent to Washington. One was prepared under the direction of a committee of the Construction League of the United States. Its provisions are sweeping in that it would cover all construction including buildings, roads, docks, bridges, etc. Engineers and contractors engaged in this work are specifically stated to be included and to be subject to the provisions of this code. The code itself is very short. It sets up a committee of the Construction League to establish whatever agencies of any kind the committee sees fit and gives it power to require any information it wishes regarding the code or its operation. Supplemental codes are to be arranged by trade associations, industrial or professional groups, and are to be administered by separate committees. Over them all stands the Construction League committee which acts as the supreme head, subject only to NRA itself. Provisions are included in the code calling for adjustments of contract prices for agreements made before June 16, 1933, and specifically naming and prohibiting bid peddling. It is expected that this code will have a hearing date assigned to it early in September.

The other comprehensive code was prepared by Building Industries of America. It is not so sweeping in its coverage on the contracting side as is the other and applies to building construction only, leaving out construction of roads, docks, etc. It is much longer and more detailed than the other blanket code. Contained is provision for machinery for settling disputes.

As we go to press we are able to find a record of 18 codes which have definitely been approved by the president and are effective. Some eight are operating under presidential order, while about 70 industries are under the terms of special wage and time provisions representing modifications of the PRA. It is variously reported that from 400 to 1000 codes are on file in

Washington. This shows both how rapidly the codes are being presented and how they are piling up awaiting study, revision, and public hearing. Public hearing dates have been assigned to but few codes. Among these is the oil burner code which had a hearing on August 21. Among the ones which have received sanction to certify compliance with the PRA are the oil burner, building material, construction, electric light and power, and natural gas codes. In the main, any group can certify compliance which has presented a code which substantially agrees with the terms of the president's agreement. Where this would work hardship the group or individual applies for exemption, an individual through the local chamber of commerce, and a group through the contact office at NRA.

So fast has the signing of the PRA gone ahead that it is approaching completion, and attention is being turned toward making its provision effective generally. Elaborate machinery for this is now set up. Even now the attention of the main line organization in NRA is turning back toward taking up the code situation where it was dropped.

The chief policy is to deal with the basic industries and raw materials first. With none of the codes filed by any of the groups in this industry definitely approved, it may be some time before they are reached, although it is rumored that the building industry is to receive attention early in September. Presidential action on the oil burner code is expected momentarily as we go to press.

As most of the codes presented are not assigned to hearings, they are not yet publishable. Their provisions were tending toward uniformity before the blanket idea was applied. Now with this blanket provision being either written in or added as an amendment, they are still more nearly uniform than ever so far as maximum hours and minimum wages are concerned. They differ in their statement of what are fair and unfair practices, in the enforcement agencies set up, and in their provisions for arriving at wages above the minimum. Nearly all contain the statement barring child labor.

Since our review of last month we have received word that the following groups have codes:

National Association of Fan Manufacturers.
Industrial Unit Heater Association.
Gas Appliances Institute.
American Institute of Architects.
American Boiler Manufacturers Association and Affiliated Industries.

These, with the 16 listed last month, make a total of 21 separate codes now filed. This total does not include the half-dozen utility and blanket codes already mentioned.

As the architects' code is an early example of a professional group drawing up a NIRA code its principal provisions are of interest. It is really a code of ethics combined with a statement of minimum wages and maximum hours. It sets up 6% as the fee for full professional service, with the percentage to be based on the total cost of the work. They are also to be paid for any engineering services involved. They are not to compete with other architects on the basis of fees nor to submit "free sketches." Draftsmen of at least two years' experience are to get not less than 50 cents per hour.

The code of the Heating, Piping and Air Conditioning Contractors National Association contains statements of principles of fair practice which are here reprinted in full:

Rule 1. No contractor shall induce or attempt to induce the breach of a contract between a competitor and his customer. Provided, that nothing in this rule shall be taken to prevent a contractor who has quoted on the plans and/or specifications involved from calling to the attention of the purchaser, even though contract has been made, that the plans and/or specifications for which contract has been made do not conform in quantity or quality to the plans and/or specifications on which the interested contractor has quoted.

Rule 2. No contractor shall advertise, name, mark, or bill materials, fixtures, apparatus, or heating installations as to quantity or quality, for the purpose of, or with the effect of, misleading or deceiving purchasers.

Rule 3. No contractor shall receive, pay, or allow secret rebates, refunds, credits or unearned discounts, whether in form of money or otherwise, or extend to certain purchasers confidential prices, special service, or privileges not specifically mentioned in his original specifications.

Rule 4. No contractor shall furnish or sell labor, heating materials, fixtures, apparatus, or installations at or below cost.

Rule 5. No contractor shall substitute any heating materials, fixtures, apparatus, or installations for the kind ordered or specified without written approval of purchaser.

Rule 6. No contractor shall pay, or promise to pay, to any employee or agent of purchaser, or prospective purchaser, a commission or consideration of any character for the purpose of inducing or compensating for a sale with or without the knowledge of the purchaser.

Rule 7. No contractor shall make, cause or permit to be made or published, any false or deceptive statements on, or concerning the business policies of, a competitor.

Rule 8. No contractor shall accept or give securities, bonds, mortgages, stock, promissory notes, or other personal or real property, at other than its market value as determined by independent appraisal, as whole or part payment for work or material.

Rule 9. No contractor shall place blanket orders or future delivery contracts for the same material for the same job, or contract with more than one concern when the total so ordered or contracted for is in excess of the material required for the job. Such orders or contracts shall contain sufficient information to identify definitely the job for which the orders are placed.

Rule 10. No contractor shall accept contracts on a "fixed fee basis" or "cost plus basis," with an "upset price," protecting the owner against higher costs, but not protecting the contractor against losses.

Rule 11. No contractor shall undertake to complete a contract upon which another contractor has temporarily stopped work because of non-payment of amounts properly due.

Rule 12. The contractor shall adhere to such terms of sale as are provided in his contracts and shall enforce collection in accordance with such terms.

Rule 13. Second-hand material, obsolete, or outmoded material shall be offered and installed as such.

Rules 14 and 15 to be reported later.

EDITORIALS

We Do Our Part

PUBLISHERS, being also employers, are included in the President's Re-employment Agreement. We have joined the newly-formed Periodical Publishers Institute and have subscribed to its code. This accounts for the presence of the Blue Eagle now prominently displayed in the offices of The Industrial Press.

This is not the only step we have taken in support of the President's plans, for we have lent voice and influence in urging acceptance of his philosophy of self-government and self-regulation of industry and of all business. We have believed, and continue to believe, that his proposals constitute a real opportunity if the most interested parties will but recognize them as such. We believe, too, that they are not perfect; that there will be difficulties and troubles, and that their final result will not be any Utopia. Business will still not be automatically either profitable or effortless, but it will have a chance to prove its own contention that there is no reason for government interference in its affairs. The President has outlined the only plan which seems capable of offering this chance with that popular support so necessary to its success. We believe that it deserves a thorough and honest trial in actual practice. We have no patience with sniping, evasions, or false support.

Codes for this industry are now drawn and awaiting hearings. The full opportunity for self-regulation will soon be at hand for all of us. We have no doubt that with the necessary adjustments which time will dictate this industry will prove itself capable of regulating its own affairs.

●

Modernizing Public Buildings

SEVERAL plans have been advanced looking toward making funds from the Public Works Administration available for the building field. In our estimation the one of most outstanding merit is that of Russell Grinnell. Briefly, he suggests that the modernizing of the mechanical plants of existing public buildings is one process by which public works money can be put to use, and which furnishes a high ratio of labor cost to total cost while bringing about improvements which will be quickly self-liquidating. These are the very specifications laid down as being most desirable for the placing of these funds.

NRA has occupied the limelight so consistently in recent months that its companion administration—that of Public Works—has been pushed into the background of public attention. It is an essential part of the new deal, however, and is intended to stimulate work and increase consumption buying. It has been slow in getting under way largely due to a lack of projects actually in a state to go ahead.

Building projects which might be eligible for these funds are, in all but a few cases, in a nebulous state. Here and there slum clearance plans are approaching completion. A moderate amount of money is now allocated to building new government buildings and a few have gone ahead. On the whole, though, the building side of the great construction industry has not been in a position to claim funds. As a result up to now the allocation has been toward the so-called heavy construction.

If the claims of the building industry, or any of its parts, are to receive adequate consideration they must be backed by definite plans and specific proposals. In the case of mechanical equipment this means that we, the most interested parties, must take the initiative ourselves. Others certainly cannot be expected to push our claims for us.

In our opinion this element of definiteness is the first merit of Mr. Grinnell's suggestion. It gives us something concrete to rally around.

Next, it opens up a field of truly great proportions. With the thousands of old public buildings throughout the country the number which could really be benefitted by a survey and modernization of their heating equipment would be tremendous. Many of them were built from 10 to 30 years ago.

Then, it should be recalled that the proposal does not intend to add to existing buildings or to their operating expense. Instead it proposes actually to reduce the yearly expense, and make those new developments, of which we in the industry are all so proud, available to these older buildings which could not incorporate them at the time of construction.

In the next place it brings us to a realization of the amount of work to be done to make the proposal bear fruit. In almost no case are any plans in existence for work of the kind contemplated. Surveys must be made and recommendations incorporated into plans. These must be passed on, approved, and the local authorities interested.

Last of all, we believe that the proposal is a distinct challenge to the whole industry to go to work. The potential is there. The claim is just. Funds will be available if the claim is properly presented and adequately pushed. It is a big job and one which every last man can support. We are squarely behind it and urge every reader to be prepared to help. Every other interested industry will soon be presenting a united front to advance its claims. So should we.

Preliminary work is already under way. What is most urgently needed now is a unified organization and enough concrete facts on a few projects to impress the authorities with the worthwhile character of what is proposed.

Abstracts . . .

**Reviews and Summaries of. . . .
Current Papers, Books and Pamphlets**

Comprehensive School Building Bibliography

Periodicals published a great number of articles on the construction and equipment of school buildings during the years 1927-1932. Anyone who doubts its bulk will be surprised at the number of titles listed in the two pamphlets just issued by the Bureau of Co-operative Research at Indiana University. These two bulletins not only list titles but briefly abstract the contents of articles which appeared during 1927-1932 on almost every phase of school building. This was a period when the open-window controversy was attracting much attention, and heating and ventilating comes in for a good share of listing.

[*Title: "Bibliography of School Buildings, Grounds and Equipment," Parts 2 and 3, by Smith and Noffsinger. Paper-covered pamphlets, 6 in. × 9 in., 182 and 130 pages, respectively. Obtainable from University bookstore, Bloomington, Indiana; price 50 cents each.*]

●

Cost of Ice Cooling

Engineering and cost data are presented on a central cooling system using ice installed in the general office of The Merchants Ice & Cold Storage Co., Louisville. The installation was made primarily for display purposes, and secondarily to provide operating data.

Chilled air is discharged into the office, containing 33,900 cu. ft. of space, through two grilles near the ceiling, and is exhausted through a transom opening near the ceiling. Early experiments with the exhaust opening near the floor resulted in objectionable drafts, dead air pockets, and unsatisfactory removal of odors. The return air was passed through a spray chamber in which it was cooled by ice water and recirculated, but it was found desirable to introduce from 10% to 17% of fresh air with the recirculated air in order to keep down smoke and other objectionable odors.

The system is controlled automatically, a uniform temperature being maintained by a room thermostat and a dew point thermostat located at the discharge from the washer. It was originally intended to maintain a temperature of 80° with 50% R.H., which proved comfortable to transient occupants, but was uncomfortably warm to the regular inhabitants. The temperature was then lowered to 75° with 50% R.H. and the temperature adjusted gradually upward until the maximum temperature for comfort was determined. It was found that slightly higher temperatures were comfortable during July and August than were suitable for June and September.

Cost records kept during 1932, for Louisville a nearly normal summer, showed that 1.5 cents per hour for ice, and 3 cents per hour for power for fan and pump, were expended for each 1000 cu. ft. of space conditioned. This is based on an ice rate of $3.50 per ton, and a power cost of 4 cents per kw-hr. With the original hook-up, waste water was being discharged to the sewer at 35°. It was found that the installation of a float valve and tank connections at an additional cost of $35 would raise the temperature of the discharged water to 56°, representing a saving of 30 tons of ice per season. Addition of a fin-tube radiator in the fresh air intake at a cost of $250 would further extract heat from the ice water, permitting it to be discharged at 66°, resulting in a saving of another 14 tons of ice.

[*Title: "Display Installation of Comfort Cooling System Using Ice," by Judson Neff. Printed in "Ice and Refrigeration," Chicago, August,* 1933.]

●

New A. S. A. Year Book

The most recent edition is dated 1932-1933, no separate edition having been issued in 1932. A complete list of all projects before the Association are listed and the status of each is given. The Association procedure is outlined and its members are listed.

[*Title: "American Standards Year Book." Paper-covered; 44 pages; 7¾ in. × 10½ in. Published by American Standards Association, 29 West 39th St., New York; no price stated.*]

●

A Study of Heat Transfer in Unit Coolers

Unit coolers have been applied to various air-cooling jobs—both process and comfort—using performance data based on tests conducted by their makers or else arrived at by trial or computation. Almost no such test performance data were made public until Professor Woolrich and his students at the University of Tennessee reported their results at the recent A.S.R.E. meeting in Chicago.

The tests consisted of setting up a dry-surface coil, floor-mounted unit with conventional fan and inlet and outlet arrangements, in a room specially constructed to accommodate it. Suitable measuring apparatus was installed and indicating gauges and instruments made possible the collection of the test data. Procedure in testing was developed by trial and the authors of the report record that they found it necessary to discard much data at the start.

Effects of only some of the possible variables are included in the paper. All tests were at constant fan speed while the coil was apparently substantially fully

flooded with ammonia. This arrangement served to stabilize these factors and any conditions dependent on them. The principal effects studied were those due to variations in the heat transfer and changes in temperature and humidity of the air and in the temperature of the refrigerant in the coil. The plotted results indicate that the testing range was from 20° to 60° entering air temperature, with humidities of from 20% to near saturation, while coil temperatures were in the neighborhood of 5° to 20°. The range thus includes those temperatures and humidities in which those units are required to operate.

The complexity of the problem and the number of variables not only make the report difficult reading, but the interpretations of the results are also complicated. For instance, total heat transfer rates increase with increase of relative humidity in case of 60° air over a 20° coil, but decrease when 45° air is passed over a 10° coil. So also the relation shown between heat transfer, relative humidity, and entering air temperature presents curves which are not only irregular but which overlap and intersect. At 60° and 85% relative humidity the heat transfer rate is virtually double that at 33° and 85%.

It is evident from the data that not only is the problem of testing difficult because of the large number of measurements to be made, but that the complications resulting from various combinations of coils, fans, etc., with speeds and volume of air make it doubtful if any directly applicable data on a given unit cooler can ever be found except by individual tests. The testing program on which the paper is based can be looked on as a fine piece of pioneer study on equipment about which there has been almost no published data.

[*Title: "Heat Transfer in Unit Coolers," by W. R. Woolrich, Paul W. Scates and Mack Tucker; A.S.R.E. paper presented at meeting in Chicago, June* 1933; *approximately* 4000 *words; illustrated by* 10 *graphs.*]

●

An Inexpensive Short Course in Air Conditioning

For some time a committee of the Heating and Piping Contractors National Association has been engaged in preparing and publishing serially a series of lessons on air conditioning for the use of its members. The lessons—10 in number—have now been collected and published in three booklets.

The material is prepared in simple style, examples are worked out to illustrate the application, and only the essential data are included. The material is thus truly in lesson form and is not of a handbook or reference nature. This style aids progress on the part of a beginner who wants to be able to apply his material as fast as he absorbs it. The simple language also helps clear thinking and workable understanding.

Not only is enough technical material included and explained so that ordinary comfort jobs may be tackled, but a list of firm names making equipment is included, as are some hints and suggestions as to suitable selling methods. On the whole, the lessons make up as good a statement of the principles and as workable a set of rules for application as have appeared.

[*Title: "Air Conditioning for Heating Contractors," three paper-covered pamphlets;* 4¼ *in.* × 7¼ *in.; total of* 194 *pages, indexed and illustrated. Available from Heating and Piping Contractors National Association, in a loose-leaf fabricoid binder; price,* $5.]

●

A Book for the Home Fireman

"Questions and Answers for the Home Fireman" is the title of a 34-page, pocket-size booklet by J. P. Barkley, which was recently issued by the Bureau of Mines. It replaces a similar booklet published some years ago by the same author. The new one contains a series of 69 questions and answers on subjects connected with the firing and maintenance of residence heating plants, including information on the several fuels and their proper use. It is prepared strictly for the home fireman and uses no technical language.

[*Obtainable by addressing the Superintendent of Documents; price,* 5 *cents.*]

●

The Eupatheoscope Used for Measuring Radiator Performance

A British instrument—the eupatheoscope—has been in use in England for some years as a means of taking measurements where relations between heat loss and comfort are desired. There were no reported instances of its use in similar work in this country until a paper was presented recently which reports on studies made at the testing plant of the University of Illinois.

The paper contains a good statement of the theory and construction of the instrument and explains how a scale for its use under American conditions was arrived at. This scale differs considerably from that used in England and both are notably empirical. The English scale uses a heat loss of 17.5 B.t.u. per sq. ft. per hr. at a surface temperature of 75°, while the proposed American scale uses a loss of 15.4 B.t.u. at a surface temperature of 83°. If there is any single fundamental law governing the true relationship it is obvious that it should not permit of such a wide variation as this. However, as the authors suggest, determination of the true underlying facts will call for additional study. Use of a tentative scale agreeing with our present practice permits studying the usefulness of the instrument as an indicator of comfort without waiting for the missing items.

Tests were conducted in the radiator testing plant, using both direct radiators and heaters of the convector type and with such conditions that a temperature of 68°, as shown by thermocouples at the 30-in. level, was maintained. Two eupatheoscopes were also located in the room—one near the cold wall and one at the center of the room. Results are shown graphically in the paper and the following conclusions are appended:

1. The eupatheoscope affords a means of evaluating the combined effect of radiation and convection in a given

environment in terms of a standard environment and in some terms related to human comfort.

2. As a provisional standard of comfort conforming to American practice, a room may be assumed to be comfortably heated when a sizeable body at 83° loses heat at the rate of 15.4 B.t u. per sq. ft. per hr.
3. Future investigation should be undertaken to correlate the readings of the eupatheoscope with a more definite standard of comfort based on a consideration of all of the physical and physiological aspects of the problem.
4. The readings of the eupatheoscope serve as a means of ranking various heating units in the order of the relative heating effects produced.
5. The steam condensation obtained when the equivalent temperature is maintained at 68° at the 30-in. level is a measure of the effectiveness of different types of heating units in providing for human comfort; lower condensations corresponding to greater effectiveness.
6. The steam condensation obtained when the dry-bulb temperature is maintained at 68° at the 30-in. level is an approximate measure of the relative effectiveness of different types of heating units in providing human comfort; lower condensation corresponding to greater effectiveness.
7. The heating effect is not materially greater than the total heat output as measured by steam condensation under given standard conditions, and the practice of adding a large proportion to the condensation rating in order to provide for heating effect, cannot be justified.
8. The proximity of cold walls has an appreciable effect on the degree of comfort as determined by the eupatheoscope.

[*"The Application of the Eupatheoscope for Measuring the Performance of Direct Radiators and Convectors in Terms of Equivalent Temperature," by A. C. Willard, A. P. Kratz, and M. K. Fahnestock; A.S.H.-V.E. paper, presented at semi-annual meeting, June,* 1933; 5 *graphs, 2 photos, 2 drawings.*]

●

Air Conditioning Automobiles

A professor of medicine at George Washington University finds that little remains to be accomplished in the further improvement of automobile design along the lines of dependability, economy, durability, speed, safety, appearance, and riding comfort, and believes that future developments will be concentrated on body refinements with particular emphasis on air conditioning. The author suggests various means for conducting investigations into the effects of such factors as carbon-monoxide distribution, temperature, relative humidity, drafts, etc., but does not discuss methods for controlling the conditions.

[*Title: "Automobile-Body Refinements and Air Conditioning," by F. A. Moss, M.D., The George Washington University. Paper presented at the International Automotive Engineering Congress of the Society of Automotive Engineers, Palmer House, Chicago, August* 28-*September* 4, 1933.]

●

More Data on Anemometers

Anemometers are much despised for measuring the air flowing out of grilles. Too many who have tried to use them have found that they give results which simply are not dependable. Still, they are about the only portable field instrument for this job. Field measurements of air flow are increasingly important, and any information which helps to make them more useful is timely.

Professor Davis reports on some aspects of their use and describes briefly some experiments with a new form of this instrument which seems to have possibilities.

His method throughout his tests was to check readings shown by anemometers against air quantities found by pitot tube measurements. Considering the pitot measurements as correct he could determine the relative accuracy of the anemometer in various situations. His report deals with studies made to learn the limitations of a previously found formula and to collect information as to manipulation procedure and modifying coefficients for various types of grilles.

A general rule was uncovered. It is to the effect that the free area used in figuring air quantity should be the minimum cross-sectional area at any point in the air stream. The author illustrates this rule in several special cases and finds that it works out well. So well in fact that he clearly regards it as applying generally. The practical difficulty in some cases, as the author well points out, is to really know in the field where this minimum area is and to be able to measure it.

A number of forms of grilles were studied as well as the effect of approach. Among the grilles were those with shutters, with straight and bent fins, and plaster and ornamental grilles where accurate measurement of free area is almost impossible. He presents curves whereby coefficients may be found to modify the usual formula to allow for various widths and percentages of free area.

The principal difficulty brought about by bad approach conditions is that the air stream does not flow through the whole grille uniformly. To cover such cases he suggests that "Where there is simply a dead region this portion of the grille should be marked off and the traverse taken only over the remaining portion through which air is actually being discharged. Needless to say, only this latter part of the grille should be used in calculating the gross and net areas." Where re-entering air is present at low velocity and over a small area only, this air may be treated as though it were not present. If the amount of re-entering air is large it is suggested that this area be treated as though it were an exhaust grille. Both parts of the grille should be traversed by the anemometer and the two volumes subtracted to get the net volume.

Methods of traversing grilles are reviewed and the spot method—where the anemometer is held in position over successive areas—is concluded to be the best. Where a moving traverse is made the author suggests that the instrument should not be moved over the face of the grille faster than 2 f.p.m. and that the run should not be less than 2 min. Edge conditions should be examined before traverse is started.

After examining several ways of using an anemometer in front of outlet grilles on unit ventilators it was concluded that none of them will produce dependable results.

[*Title: "Measurement of the Flow of Air Through Registers and Grilles," by L. E. Davies. A paper presented before the June,* 1933, *meeting of A.S.H.V.E. Approximately* 8000 *words, illustrated.*]

Your Everyday Problems

HEATING AND VENTILATING will be glad to answer your problems relating to installation and operation of heating and ventilating systems. Letters will be answered promptly, and in some cases published anonymously. If sketches are included they should be clearly drawn. Write The Editor, HEATING AND VENTILATING, 148 Lafayette Street, New York.

QUESTION 96. *Will a vapor heating system continue to supply heat to the radiators for a longer period when solid fuel is burned than when operated with an oil or gas-fired boiler?* *M. B. J.*

ANSWER: When an oil or gas flame is extinguished, the transfer of heat to the water in the boiler ceases almost immediately. Steam will continue to be generated for some little time, however, due to the lowered boiling point of the water in the boiler which is subjected to a partial vacuum from the condensation taking place in the radiators and system. The length of time that the radiators will remain warm under these circumstances of course depends upon the degree of vacuum that can be maintained, or in other words, upon the air tightness of the piping system and radiators. Heat of vaporization is obtained from the water in the system, and from the metal in the boiler itself, and these must eventually be cooled to such a temperature that steam will no longer be evolved.

With a coal-fired vapor system, however, heat transfer to the boiler water continues even after the drafts have been closed and the fires banked. Then, if the system is tight, steam or vapor will be supplied to the radiators during an indefinite stand-by period.

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QUESTION 97. *How may brass pipe be bent without marring it or deforming its cross-section?* *P. G. G.*

ANSWER: The following instructions for bending brass pipe are supplied by the Copper and Brass Research Association:

If pipe is not sufficiently soft for bending it should be annealed at the point of bending by heating it to a dull red and cooling. Screw a cap on one end, and with the pipe uniformly hot to the fusing point of pitch, pour it full of melted pitch, and allow to cool.

Where special bending forms are not available, it is recommended that a hole, slightly larger in diameter than the pipe, be bored in a thick plank or post. The mouth of the hole is then countersunk, and the pipe is bent over the edge of the hole a little at a time. A lead pipe template can easily be made, by which the correct bend may be conveniently gauged. When the bending operation is complete, the pipe is again heated to the melting point of the pitch, which is poured out.

If pitch is not available, melted resin or hot sand, packed tightly in the pipe with a pine plug driven home in the open end, will serve as well to prevent flattening and kinks at the bend. When it is necessary to make a large number of similar bends, the work can be done much more rapidly and accurately with iron bending forms, curved to the desired radius.

●

QUESTION 98. *Most of my work is in connection with electric heating, and I find that if I had a chart for computing power consumption per degree-day, similar to the charts for coal, gas, and oil as published in* HEATING AND VENTILATING'S *Degree-Day Handbook, it would be a great help to me. Is such a chart available?* *W. P. L.*

ANSWER: The computation of electric heating quantities involves so few variables that it is unnecessary to include a chart for correcting these variables in the handbook.

Electric heating is commonly assumed to be 100% efficient, since all the power consumed is dissipated in the form of sensible heat. A kilowatt-hour always evolves the same amount of heat (3415 B.t.u.) unlike solid or fluid fuels in which the calorific value varies considerably. Therefore, no corrections need be made for heating value.

The unit of power consumption per square foot of steam radiation is 0.0281 kw-hr. per degree-day. For hot water, the consumption is 0.0176 kw-hr. per sq. ft. per degree-day. The two figures given are comparable to the result obtained after following through the charts for oil, gas, or coal.

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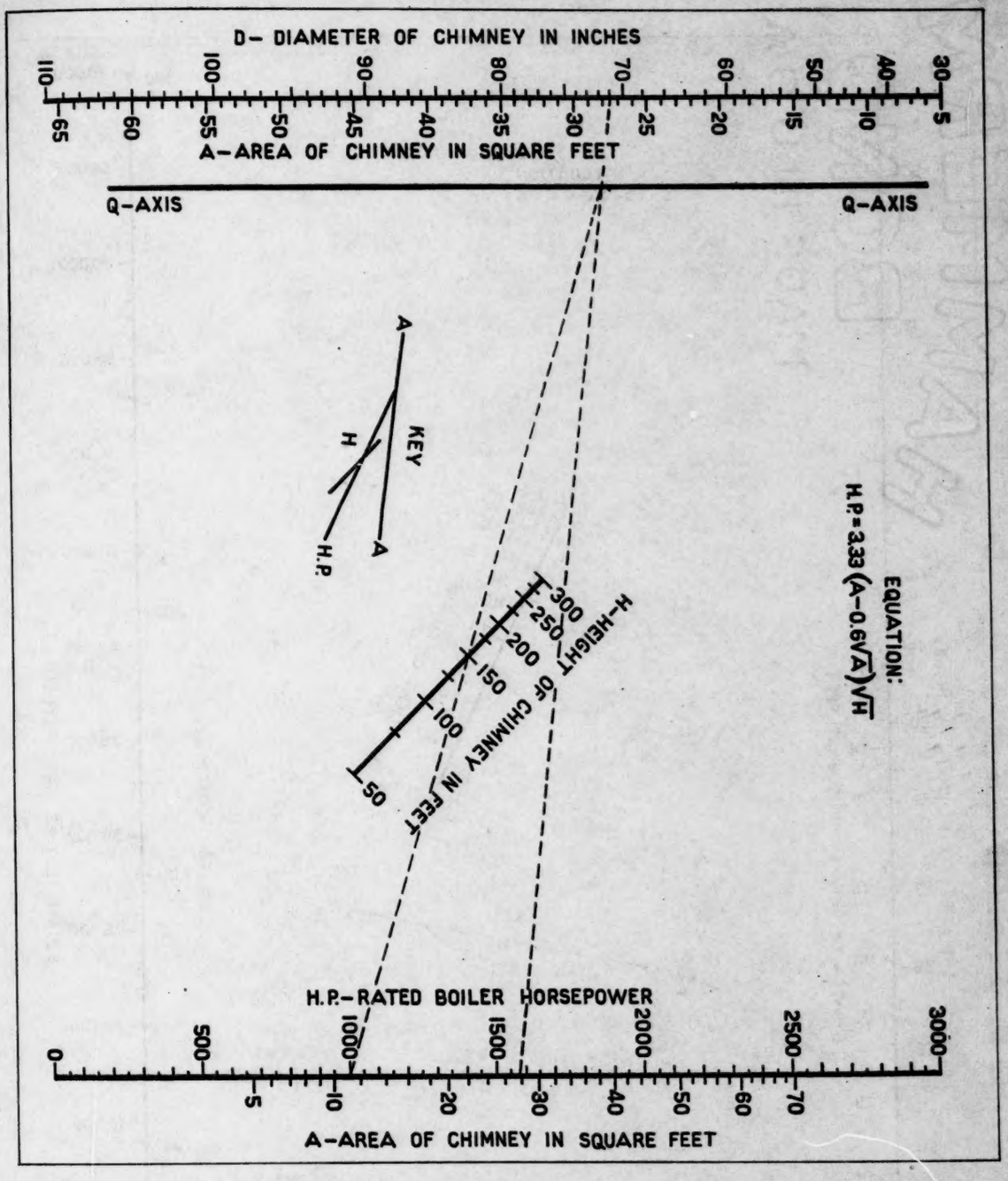
QUESTION 99. *Does oxygen contained in water cause corrosion in pipes? How may oxygen be taken out of water?* *W. E. J.*

ANSWER: It has been shown experimentally that the rate of corrosion in pipes is almost directly proportional to the amount of oxygen dissolved in the water. Oxygen is removed from water by mechanical de-aeration or by chemical treatment, whereby the free oxygen is combined to form a harmless compound. Suitable apparatus for this may be purchased. However, water in a system loses most of its dissolved oxygen upon being heated in the boiler, and hence water that has remained for some time in a hot water system is practically free of oxygen and if the system is kept full, has practically no opportunity to absorb more.

CHIMNEY SIZES



The charts shown on this and the reverse sides of the sheet, designed by J. N. Arnold, are for the determination of chimney sizes when the boiler horsepower or square feet of radiation is known. To illustrate the use of the chart shown above, assume a 1000-boiler horsepower load and a tentative height of 150 ft. for the chimney. What must be the area of the chimney? Through the 1000 point on the horsepower scale and 150 on the diagonal scale, draw a line to intersect the Q-axis. About this point on the Q-axis adjust the straight edge until identical readings are obtained on the two A scales, in this case, 27.5 sq. ft. area. The diameter can be read directly opposite the area on the left-hand scale; in this case a 71-in. diameter chimney would be required.

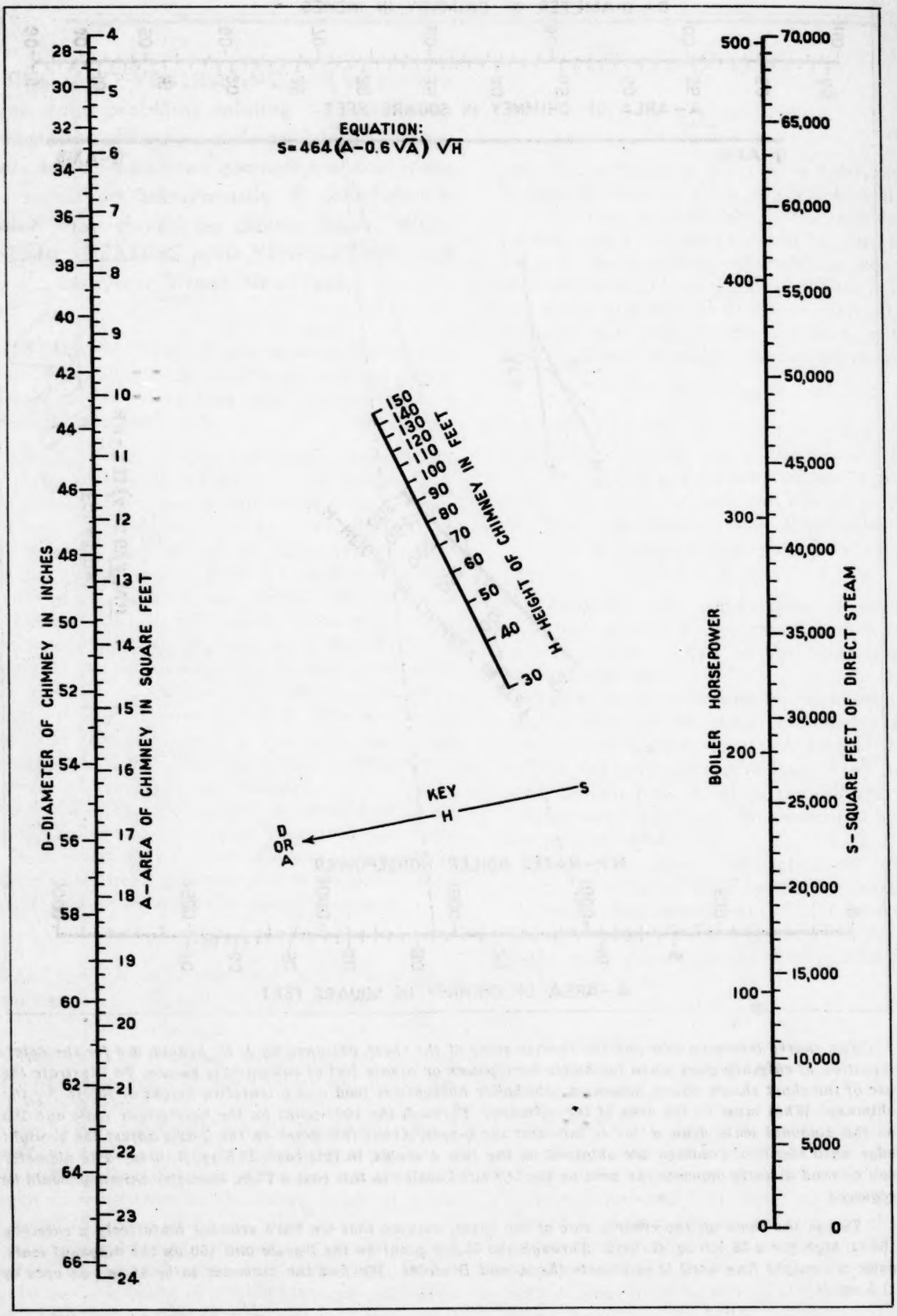
To use the chart on the reverse side of the sheet, assume that we have selected tentatively a chimney 150 ft. high for a 55,000 sq. ft. load. Through the 55,000 point on the S-scale and 150 on the diagonal scale, draw a straight line until it intersects the A and D scales. We find the diameter to be 46 in., an area of 11.5 sq. ft.

(See other side)

H. & V.'s REFERENCE DATA—17

CHIMNEY SIZES

(See other side for explanation)



News of the Month

Chicago Utilities Push Gas Heating

Utility companies operating in Chicago and surrounding territories are cooperating in a campaign to sell gas heat to the 240,000 estimated prospects within the area. The campaign is under the general managership of Fred H. Scheel, prominent in the utility field for 25 years. A new low rate schedule, based on a sliding scale which provides a reduced unit cost as the consumption increases, and a rental plan whereby the burner will be installed without initial payment, will be featured as inducements to attract customers from other fuels.

This plan provides that the customer will be billed for $3 rental on the burner per month during the first heating season, this amount to be added to the bill for gas consumed. No rent is charged during the summer months. If the customer becomes dissatisfied with the equipment or service at any time during the first year, he may order its removal and no further rental will be charged. If the customer retains the service, the amount of rent paid on the gas-burning equipment will be credited to the purchase price. With this arrangement, gas consumed in heating water, cooking, etc., is added to the total, and paid for at the same rate as the gas used for house-heating.

The first 16 days of the campaign, July 19—August 4, yielded 1398 sales, the great majority of which have been to owners of bungalows and small homes.

Master Code Framed for Construction Industry

More than 500 representatives of all branches of the construction industry met at a luncheon held at the Roosevelt Hotel, New York, August 16, under the auspices of the New York Building Congress, to hear an explanation of the proposed building trades code by Stephen F. Voorhees, chairman of the Code Committee of the Construction League of the United States. This committee has formulated a master code covering all branches of the construction industry, including building, and it is understood that each national association, representing the various phases of the industry, will draw up its own collateral code in accordance with the master code, providing for conditions peculiar to the particular branch of the industry concerned and the locality in which it operates.

Self-government in each group of the industry is the aim of the code structure, according to Mr. Voorhees, and it is the intention of the Construction League that there shall be no interference with existing set-ups. The speaker warned his listeners that in the event that the industry proved incapable of governing itself effectively and equitably, the industry would be governed by federal and state governments.

Refrigeration Fin Coil Makers Organize

Extended surface refrigeration coil manufacturers met in New York, August 8, and formed the Extended Surface Manufacturers Association. A constitution and by-laws were adopted and a tentative NRA code drawn up for submission through the Electric Refrigeration Accessory Manufacturers. Members of the new group will meet with the accessory makers August 31.

NRA MEMBER U.S.

WE DO OUR PART

HEATING AND VENTILATING *is a member of the Periodical Publishers Institute, has signed the Blanket Code certificate of compliance, and is observing the Code submitted by the Institute.*

Employment Again Increases

Employment in factories and plants manufacturing heating apparatus, expressed in terms of 1926 average = 100, rose from 40.0 in June to 43.0 in July, according to the U. S. Department of Labor. Payroll totals in the same plants increased from 25.1 in June to 27.4 in July, these figures also being per cent of the 1926 average.

Huge Steam Heating Plant Planned for Chicago

According to the *Chicago Daily Tribune*, plans are being made by The Chicago Tunnel Company for what will be the largest district heating project in the world, with capacity for heating the downtown business district of Chicago. The report states that the company has purchased a $700,000 site and contemplates the erection of a $7,000,000 plant.

The Chicago Tunnel Company owns and operates 62 miles of underground passageways through which coal deliveries and ash removals for buildings in the Loop area are made, and under present plans steam at 400 lb. pressure will be conveyed through them in 24-in. mains. It is estimated that nearly a billion and a half cubic feet of building volume will be made accessible to steam mains through these tunnels. Coal consumption for an average winter day will reach 1200 tons according to estimates.

It is understood that the work will be undertaken as soon as negotiations for financing the project are completed. The report states that representatives of the company have arranged a loan of $4,000,000 with the R.F.C., and are now negotiating for the $5,000,000 additional capital which will be required to complete the work.

Wholesale Prices Continue to Rise

Wholesale prices of heating and plumbing materials, in per cent of the 1926 average, rose from 67.4 in June to 69.4 in July, according to

the U. S. Department of Labor. These compare with 67.1 for July, 1932.

Wholesale prices of all building materials increased from 74.7 in June, to 79.5 in July.

New York Subway Experiments with Soundproofed Car

A soundproofed subway car with windows and doors sealed closed and ventilation induced by seven exhaust blowers in conjunction with the usual propeller-type ceiling fans, is being operated experimentally by the Interborough Rapid Transit Company in New York's underground railway system. Engineers in charge of the tests claim that the equipment reduces the noise within the car from an average sound intensity of 81.03 decibels to an average of 61.50 decibels, which is only slightly greater than the sound intensity within a modern Pullman car.

Supply air enters through baffled vents, passing through several acoustical chambers and a considerable length of ductwork before it is admitted to the car. Introduction of this air is induced by seven Sturtevant duplex ¼-hp. exhaust blowers, each of 714 c.f.m. capacity, located in the roof of the car, two in the vestibules, and the remaining five spaced throughout the length of the passenger space at approximately 6 ft. intervals. The standard evaporation fans are located between the blowers, and serve to keep the air in motion.

Blowers are automatically controlled by a heavy and light load registering device which provides for the operation of but four units when the passenger load is light, and cuts in the remaining three when the load is heavy. This device also provides for the automatic opening of the windows in the event of failure of the ventilating system.

Officials of the company expect to place a 10-car train, fully equipped for soundproofed ventilation, in regular passenger service in the near future, to determine the public reaction to the scheme. If the idea proves successful, it is planned eventually to install the equipment in all of the company's 2200 cars.

Free Courses in Heating in New York Evening Schools

Free evening courses in heating, ventilating, refrigeration, and air conditioning are offered this fall in connection with other training work in the building trades by the Board of Educaton, City of New York, in cooperation with the Building Trades Educational Committee, Room 633, 101 Park Ave., New York, and the New York City Heating and Piping Contractors Educational Committee. Classes will commence September 25, and will be conducted at the Brooklyn Evening Technical School and Stuyvesant Evening Trade School.

The three-year course in steam engineering, refrigeration, and air conditioning, covers a general discussion of steam generation and utilization along with an elementary study of mechanical refrigeration during the first year. Theory of combustion, steam heating systems, automatic control, air conditioning theory, and various forms of refrigerating equipment are taken up in the second year. The third year curriculum includes steam transmission, ventilation duct design, steam plant design, and a study of cost determinations. In addition, advanced work is offered during the second year in heating, ventilating, and air conditioning, and an extension course may be taken in thermodynamics and theory of air conditioning and refrigeration.

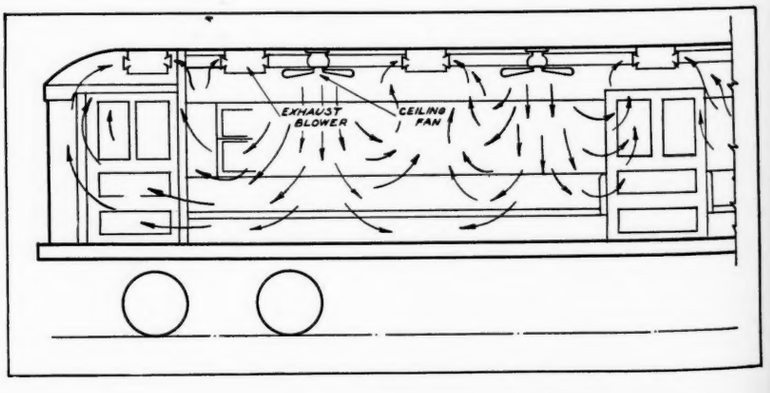
Full information can be obtained from the Board of Education, the schools, or the committee.

Rea New President of Stoker Association

The annual meeting of the Stoker Manufacturers Association was held at the Palmer House, Chicago, July 24-25, with a large attendance. Officers elected for the ensuing year were: president, W. H. Rea, Detroit, president of the Detroit Stoker

SOUNDPROOFED SUBWAY CAR

Dr. Shirley W. Wynne, Health Commissioner, City of New York, left, examines noiseproof ventilating equipment on experimental I. R. T. subway car. Exhaust blowers and ducts can be seen at the top of the car. The ventilation of the car is shown schematically below.



Old Heidelberg Inn, popular eating place of the Chicago A Century of Progress Exposition, ventilated with IIg power roof ventilators, which consist of motor-driven propeller fans in penthouses. Arrows show locations of several of the ventilators.

Company; vice-president, J. R. Whitehead, Chicago, Fairbanks Morse & Company; treasurer, Harry H. Kurtz, Chicago, Iron Fireman Manufacturing Company; secretary, Marc G. Bluth, Chicago.

A number of new members have joined the Association, including such well known companies as Motorstoker Corp., New York; Holcomb & Hoke Manufacturing Co., Indianapolis; Link-Belt Co., Chicago; Fairbanks Morse & Co., Chicago; McClave-Brooks Co., Scranton, Pa.; Whiting Corp., Harvey, Ill.; Whitty Manufacturing Co., Boston; Kol-Master Corp., Oregon, Ill.; Columbus Metal Products, Inc., Columbus, Ohio; Cotta Transmission Co., Rockford, Ill.; Schwitzer-Cummins Co., Indianapolis, and Sinker-Davis Co., Indianapolis.

A National Industrial Recovery Code was adopted for the stoker industry, and this has already been filed with the NRA in Washington. The stoker code will comply with the requirements of the President's Re-employment Agreement and will conform to the National Industrial Recovery Act.

A. O. B. A. Arranges Group Insurance for Members

Low cost group insurance for those in the oil burner industry has been arranged by the A.O.B.A. with the Bankers National Life Insurance Company of New Jersey. Available through association membership to all those whose ages are over 21, the blanket policy stipulates that no medical examination is necessary for policies up to $3000, unless the applicant is more than 50 years of age, providing that the applicant's general statement is found satisfactory by the insurance company. Through this arrangement, all officers of corporate members of the Manufacturer Division, all officers or partners of the Dealer Division membership, all individual members, and all employees of manufacturer and dealer members who become members of the Individual Division of the association, are eligible.

Rates commence at $7.59 per thousand for those 21 years old. Responsibility for this insurance is not in any way based on the resources of the A.O.B.A., but rests entirely with the insurance company and W. A. Kirk, 342 Madison Ave., New York, trustee in behalf of the insured. Application for insurance should be made to Mr. Kirk.

Electrical Show to Feature Air Conditioning Products

Air conditioning and refrigeration equipment will be on display along with recent developments in the electrical and radio fields at the 1933 National Electrical Exposition to be held at Madison Square Garden, New York, September 20-30. According to Clarence L. Law, president of the Electrical Association of New York, sponsors of the show, the industries taking part in the exposition desire not only to cooperate with the N.R.A. campaign, but also wish to be among the first to indicate their approval of President Roosevelt's appeal by stimulating the sale of their products to a responsive buying public.

Among the exhibitors are: Campbell Metal Window Corporation, Delco Heat, Electrol, Incorporated, Frigidaire Sales Corporation, General Electric Company, The Kelvinator Corporation, The Petroleum Heat and Power Company, and Westinghouse Electric and Manufacturing Company. D. W. May, May Radio and Television Corporation, is chairman of the exposition.

More Conditioned Cars for Railroads

Air conditioning equipment was installed recently in 20 additional cars of the Baltimore & Ohio Railroad. The equipment was built by York Ice Machinery Corp., York, Pa., and installation was made at the railroad company's shops. The B & O now has a total of 162 conditioned sleepers, chair cars, diners, and coaches in service.

All trains of the Pennsylvania Railroad operating between New York and Washington have been air conditioned, and the company is now installing equipment on trains operating between New York and Philadelphia.

Worthington Pump Appoints Chicago Dealer

Worthington Pump and Machinery Corp., 400 West Madison St., Chicago, announces the appointment of Kroeschell Engineering Co., 2306 North Knox Ave., Chicago, as its dealer in the Chicago area for the company's refrigeration equipment.

July Building Permits Off

There was a decrease of 10.6% in the number, and a decrease of 11.3% in expenditures for total building operations in July as compared with June, according to the building permit reports received by the Bureau of Labor Statistics from 776 identical cities having a population of 10,000 or over.

News of the Month

New residential building decreased 8.8% in dollar volume, while new non-residential building decreased 4.9% in dollar volume. Additions, alterations, and repairs dropped 19.8%.

Mercur Opens Office

Nathan L. Mercur, 1916 Clark Building, Pittsburgh, Pa., formerly connected with the Hook Heater Company, has opened his own office and is specializing in the design and development problems of gas control devices, thermal motors, and air conditioning apparatus for manufacturers.

Coke for Heating Gains in Popularity

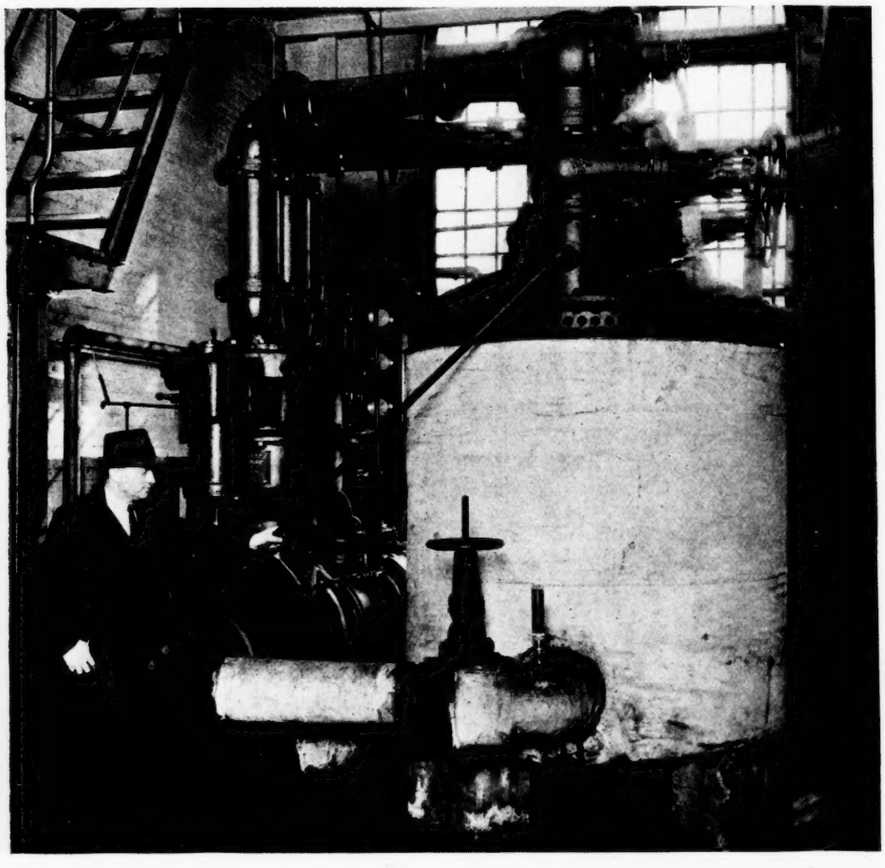
According to a preliminary report published by the U. S. Bureau of Mines, there is a growing demand for coke for domestic heating. While other uses have shown marked declines during the depression, sales of domestic coke have increased each year to 9,457,259 tons in 1932, an increase of 11.3% over 1931.

Cunningham Stoker Co. Formed

Cunningham Stoker Company, 2832 East Grand Blvd., Detroit, has been formed by James G. Cunningham to manufacture and deal in stokers and various heating appliances.

A. O. B. A. Protests Plan of Chicago Gas Company

With the launching of a house-heating campaign by the People's Gas, Light and Coke Company, Chicago, and affiliated interests, the American Oil Burner Asosciation filed a protest with the Illinois Commerce Commission stating that the campaign as concurrently under operation was (1) unfair competition, (2) unethical advertising, and (3) contrary to the public interest. Similar protests have been made directly to the People's Gas, Light and Coke Company, the Public Service Company of Northern Illinois, and Lord and Thomas, the advertising agency.



This 35-ton steam jet refrigerating unit has been cooling drinking water at the plant of the Union Switch & Signal Co., Swissvale, Pa., for 15 years. More than a mile of cork-insulated pipe connects 80 drinking fountains in the closed system. The unit was built by Westinghouse.

Swan Heads National Radiator Gas Division

National Radiator Corp., Johnstown, Pa., has appointed C. MacDonald Swan manager of its gas heating division. Mr. Swan formerly represented the company as its gas boiler representative in the Washington, D. C., territory.

Previous to his connection with the National Radiator Corporation, Mr. Swan held positions with the Utah Gas and Coke Company, Utah Copper Company, Central Public Service, Washington Gas Light Company, and the Lovekin Water Heater Company.

Detroit Stoker Appoints Moore

Detroit Stoker Co., Detroit, announces the appointment of William W. Moore, 180 Westminster Drive N.E., Atlanta, Ga., as its representative in the south.

Equipment Sales Rose in June

Among the encouraging news reported in recent statistical data are the equipment figures covering this industry and reporting operations for the month of June. Shipments of non-ferrous heating surface showed an increase over May of 75.5%, although the usual seasonal trend is a 28% decrease. Likewise, stoker (for heating plants only) sales gained 32.8% in June, although normally there is a gain of only 10.6% in June compared with May. Shipments of domestic and commercial oil burners in the United States rose 8.9% in June over May, although the normal trend is a very slight drop in shipments.

Paul Close Returns to Celotex

Paul D. Close, formerly technical secretary of the A.S.H.V.E., has become associated with The Celotex Co., Chicago, as chief engineer of

the industrial uses division. He will be identified with the development of new insulation products in the low temperature field.

Mr. Close was employed by The Celotex Company before his connection with the A.S.H.V.E.

Modine and Nelson Also Belong

The names of Herman Nelson Corp., Moline, Ill., and Modine Manufacturing Co., Racine, Wis., were inadvertently omitted from the list of original members of the newly-formed Concealed Heater Manufacturers Association, as announced in the August, 1933 issue of HEATING AND VENTILATING.

Weber New Coppus Representative in Kentucky

Coppus Engineering Corp., Worcester, Mass., has appointed John O. Weber, 122 Main St., Louisville, Ky., representative for the state of Kentucky, excluding Boone, Kenton, Campbell, Pendleton, Bracken, Mason, and Lewis Counties, which will continue to be served from the Cincinnati office.

A. S. A. to Continue Government's Standardization Work

Provision is being made by the American Standards Association to continue the investigations on simplified practice and industrial standardization recently turned over to it by the Department of Commerce's Bureau of Standards, according to a letter signed by Howard Coonley, the Association's president. A skeleton staff will be maintained by the Bureau during the transition period to facilitate the transfer, and plans are now being made to secure additional financial support for the A.S.A., with which it is hoped that a number of the Bureau's personnel can be taken over.

It is the opinion of Secretary of Commerce Roper and Mr. Coonley that the new arrangement will work to the advantage of industry, the public, and the government, since responsibility will be concentrated in a single organization representative of each.

Fairkol Stoker Corp. Formed

William L. Bowman, 342 Madison Ave., New York, recently incorporated the Fairkol Stoker Corporation to manufacture stokers.

New Dealers for Fluid Heat

Fluid Heat Division, Anchor Post Fence Co., Baltimore, Md., recently added the following dealers: Patrick Hackett Hardware Co., Ogdensburg, N. Y.; Cone Oil Burner Service, Bennington, Vt.; Modern Necessities Co., Maplewood, N. J.; and Automatic Heating Engineers, Chicago.

New McIlvaine Dealers

McIlvaine Burner Corp., 663 West Washington Blvd., Chicago, announces the appointment of the following new dealers: Wallace Stebbins and Sons, 100 South Charles St., Baltimore; Erickson Plumbing and Heating Co., 514 Thirteenth St., Moline, Ill.; Automatic Heating Sales Co., Kalamazoo, Mich., and J. D. Johnson Co., Inc., 139-43 North 7th St., Philadelphia, and Newton Ave. and Division St., Camden, N. J.

Hoffman Makes Announcements

Hoffman Specialty Co., Waterbury, Conn., announces that C. V. Haynes, long associated with its company as vice-president, will devote more and more of his time to research work for the company.

M. C. Gillette, Philadelphia, has been appointed Hoffman zone manager for the south-eastern states.

Bryan Steam Makes Appointments

Bryan Steam Corp., Peru, Ind., has appointed J. C. Auglera, 90-07-184th Place, Hollis, Long Island, N. Y., as a distributing representative for that territory.

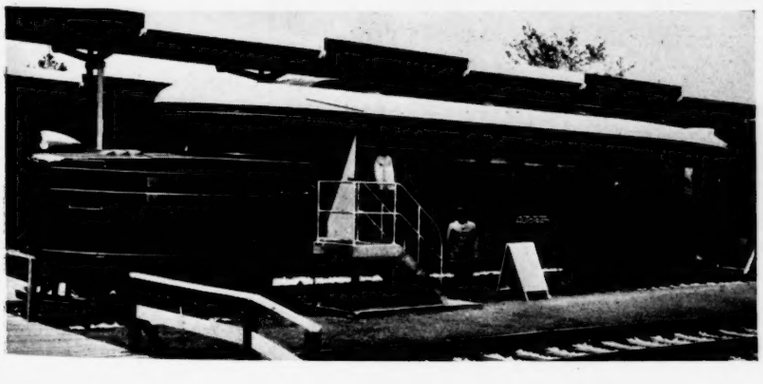
William H. Austin, formerly with the National Radiator Corporation, has joined the Bryan Corporation in the capacity of engineer, with offices at Peru, Ind.

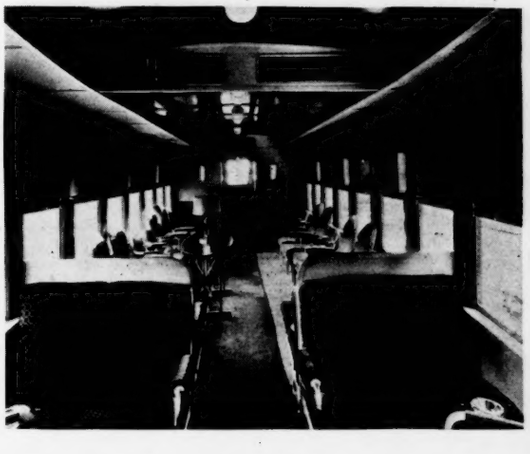
New Petro Dealers in New York State

Petroleum Heat and Power Co., Stamford, Conn., announces the

AIR CONDITIONED AUTOTRAM

The air conditioned streamlined aluminum alloy Autotram, a railway car designed to maintain a speed of 75 miles per hour. It is powered with a 16-cylinder, 160-hp. automotive engine, and rides on steel wheels with rings of rubber. A 7-kw. generator operated by an individual gas engine provides power for the 2½-ton Frigidaire compressor. The car, built by the Clark Equipment Company, is 60 ft. long, holds 40 passengers. Another car, under design, will be 86 ft. long, seating 72 passengers.





News of the Month

recent appointment of dealers in New York State, as follows: Frank N. Hermus, Bellport; Charles Appleyard, Montauk; Carrol E. Martin, Southampton; John T. Sadler Co., Elmira; Townsend Hardware Co., Oneonta.

H. Lee Moore Changes Address

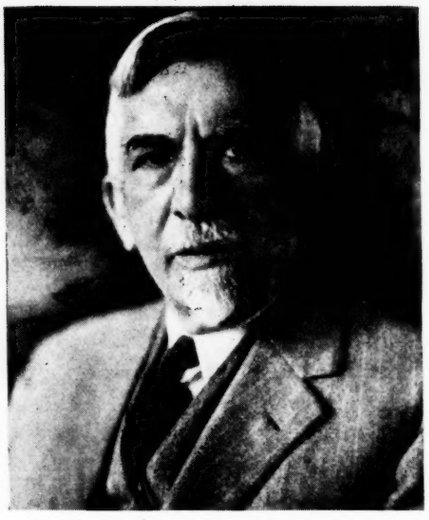
H. Lee Moore, Pittsburgh representative of Buffalo Forge Company and Buffalo Pumps, Incorporated, has moved to 912 Fulton Building, Pittsburgh.

John H. Waters

John H. Waters, president of National Radiator Corp., Johnstown, Pa., died August 14 in Washington, D. C. Mr. Waters, who was 74 years old, suffered a cerebral hemorrhage while conferring at the Treasury Department with officials of the Bank Reorganization Division. He was president of the United States National Bank of Johnstown.

Born in Davidsville, Pa., Mr. Waters was instrumental in the formation of the Fowler Radiator and Manufacturing Co., Norristown, Pa., which concern he purchased in 1896, moving the operations in that year to Johnstown. In 1902 the name was changed to National Radiator Company. A modernly equipped plant was put into operation in Trenton, N. J., in 1911.

In 1918, Federal Radiator Co., New Castle, Pa., was acquired by National Radiator, and in 1927 these plants and five others, Union Radiator Company, Gurney Heater Manufacturing Company, Continental Heater Company, Utica Heater Company, and Niagara Radiator and Boiler Company, were merged into the National Radiator Corporation, of which Mr. Waters was made chairman of the board of directors. Due to financial difficulties during the depression the company went through a reorganization, following which Mr. Waters was made president of the corporation, the position he held at the time of his death.



The late John H. Waters

Mr. Waters is survived by a son and two daughters.

Arthur T. North

A. T. North, widely known engineer and architect of New York, died suddenly at his home August 16 of heart failure.

He was born in Kewanee, Ill., October 15, 1864, and was a descendant of John North who came to this country on the *Mayflower*. He graduated from the University of Illinois in 1885 with an A.B. degree, and later was awarded a Master's degree.

Mr. North's professional record was long and varied, and the positions he held included that of chief engineer for Wells Brothers, Chicago; engineer for the Southern Pine Association; in charge of architectural relations for the American Institute of Steel Construction, and engineering editor of the *American Architect* and *The Architectural Forum*. He was the author of many articles, and had contributed to this publication, as well as the A.S.H.V.E. He was also the author of several monographs on prominent architects.

Mr. North was a member of the American Institute of Architects, American Society of Civil Engineers, Illinois Society of Architects, Architectural League of New York, Construction Council, American Civic Association, White Chapel Club of Chicago, Founders and Patriotic Club of America, Sons of the American Revolution, and several Masonic organizations.

COMING EVENTS

SEPTEMBER 20-30, 1933. National Electrical Exposition, to be held in Madison Square Garden, New York.

SEPTEMBER 25-29, 1933. Fifteenth Annual Convention of the American Gas Association, to be held in Chicago. Headquarters at the Hotel Stevens.

FEBRUARY 5-8, 1934. Fortieth Annual Meeting of the American Society of Heating and Ventilating Engineers, to be held in New York. Headquarters at the Hotel Biltmore.

FEBRUARY 5-9, 1934. Third International Heating and Ventilating Exposition, to be held in the Grand Central Palace, New York.

NEW CATALOGS

Electrol, Inc., 227 East 45th St., New York, has published "The Easiest and Cheapest Way to Heat Your Home," an elaborate consumer booklet describing the Electrol Kewanee heating unit. It is profusely illustrated and attractively arranged; 11 in. × 7¾ in., 32 pages.

Frigidaire Corp., Dayton, Ohio, has issued "Relief from Hay-Fever and Other Disorders by Means of Frigidaire Air Conditioning," a booklet in which the symptoms and causes of allergic diseases are discussed in a popular manner. The use of air conditioning in combating the affliction is explained; 32 pages, 5¾ in. × 8 in.

Hoffman Specialty Co., Waterbury, Conn., recently issued a new price list of its venting valves. The new list is dated July 31, and prices went into effect on that date. Descriptions, engineering data, and illustrations of the company's complete line of heating specialties are also available in a series of four bulletins.

Independent Register & Mfg. Co., 3747 East 93rd St., Cleveland, has issued Catalog No. 33 FA describing and illustrating its line of grilles and registers for forced heating and ventilating systems. Dimensional data and prices are included; 24 pages, 6 in. × 9 in.

The Nash Engineering Co., South

Norwalk, Conn., has issued Bulletin No. 217 describing and illustrating the complete line of Nash pumping equipment, including vacuum heating pumps, sump and sewage pumps, sewage ejectors, and air pumps and compressors; 35 pages, 7½ in. × 10¾ in.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has issued a bulletin describing construction and operation of Type G high-speed synchronous motors for fans, blowers, compressors, pumps, and similar applications. Standard size, 4 pages.

Correspondence

Relation Between Specialty Manufacturer and Consulting Engineer

EDITOR, HEATING AND VENTILATING:

The business of the professional consulting engineer includes the planning and writing of specifications for the structural, heating, ventilating, plumbing, electric wiring, and other similar trades with equipment in the building. These sciences constitute specialties in themselves which have required many years of study and practical experience on the part of the consulting engineer in order to master them. It is not to be expected that an architect can be or is fully conversant with the details of design of all these features which enter into the construction of a building, and, for this reason, the architect should avail himself of the consulting engineer's advice and service concerning the design and supervision of the mechanical and electrical systems and equipment.

Who should supply this service to the architect? The consulting engineer or the material manufacturer and his sales representatives who have materials for sale that might become a part of the completed building? These are facts which I believe are frequently lost sight of and become sources of many misunderstandings.

In the first place, the material manufacturer or his sales representative if he prepares plans and specifications gratis to the architect, a common practice, is generally forced to render this service for no further compensation than that what may be added to the cost of his materials that can be included on his proposal. Again, the manufacturer or his representative in order to insure the use of his equipment often prepares plans involving the use of other equipment than what he sells. This is particularly true in heating and ventilating designs and it has been a known fact that the other equipment salesman's commission often amounts to more than the designer's commission. Further, often the manufacturer in making these plans is just making plans for his competitor to shoot at, so to speak, invariably resulting in losing the business if he has been fair in his proposal. Engineering service can not be rendered for nothing and under these conditions it must then become an unproductive overhead.

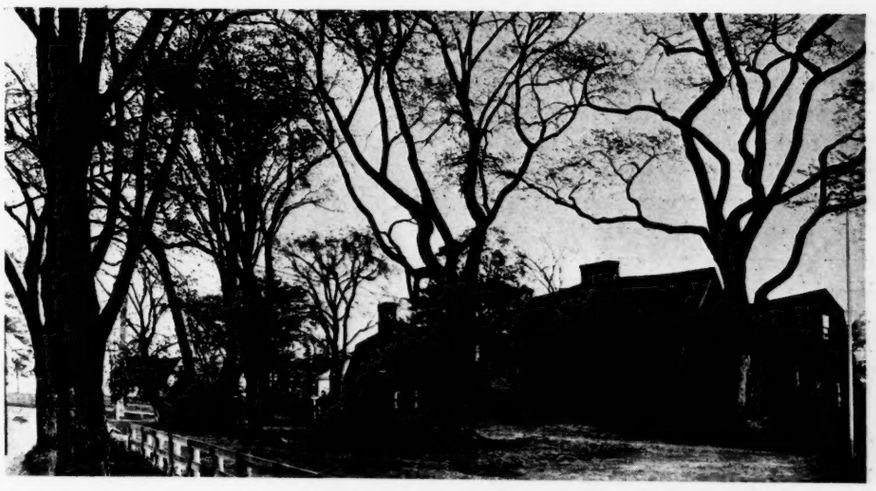
It does not require much study to show that such practice is wrong as well as non-profitable and it is equally evident that such practice is unfair from the standpoint of the consulting engineer in private practice who depends on this business for his existence.

Correspondence

The relation then of the professional consulting engineer, the material and equipment man, the services each has to offer and their mutual dependence is of paramount importance and it is imperative that they be drawn closer together in solving such problems as bear upon their respective efforts and welfare.

The material manufacturer or his representative should have as his objective the interesting of the consulting engineer in his product, his company, and himself, for the consulting engineer desires the best product comparable with the nature of his project. He must know that the company back of the product is reliable and financially responsible and he must have confidence in the sales representative. If any of these is lacking or in doubt, misunderstanding is likely to be created. It has often been stated that no one sales representative can be both an efficient salesman and prepare engineering plans, because he can not practice both effectively at the same time.

The trouble is that too many salesmen think that they can do both and often actually attempt to do so. Such conditions have arisen in the past, exist today, and doubtless will in the future to a greater or lesser extent, but I am sure to an ever-decreasing extent as the



A 300-YEAR OLD HOUSE

believed to be the oldest frame house standing in America today. It was built by Jonathan Fayerbanks in 1636 and owned and occupied by him and his lineal descendants ever since. The building materials were imported from England in 1633. The building is located in Dedham, Mass., where the Fairbanks family in August celebrated the 300th anniversary of the arrival of the family in this country.

Correspondence

consulting engineer and the material manufacturer or his sales representative come to a more profound realization that they are participants in a common cause. The professional consulting engineer should in no sense be the rival or competitor of the material manufacturer or his representative, because the specialty man is as essential to the consulting engineer as the consulting engineer is to the salesman, but the two can not be *competitors* in the same field and still create a mutual understanding.

In this connection it likewise should be understood that no professional consulting engineer or any member of his organization should be connected with or engaged in any way in any of the engineering trades or manufacturing interest in which he specializes. He should show absolute impartiality towards all good makes of materials, apparatus, trade, and contracting interest, and should render his work so clear, concise, and open to competition that the fairness and economy of his methods will appeal to all.

To the credit of some material manufacturers it must be stated here that in recent years many have discontinued the practice and some have even refused to allow their representatives to prepare plans and specifications for architects and contractors. There still are, however, some who continue the practice, partly because they feel that their competitor manufacturer or sales representative will do it if they do not and partly because they feel they will create enmity from the architect or contractor by refusing this gratis service. Is this not a poor remedy to cure an evil? Wouldn't organized cooperation be a better solution? It would appear an excellent undertaking, one which should be promoted energetically.

Some who read the foregoing will doubtless condemn my thoughts emphatically, saying that all of the faults and none of the virtues are mentioned. However, they at least must understand the consulting engineers' problem and know the methods by which they are trying to solve them. I think these methods are not only fair to all parties concerned but reasonable and intelligent as a policy.

These are the days for thought of the new deal, and, as the construction industry is to be included in this plan, why not have cooperation of the material manufacturer and his representatives with the professional consulting engineer? I am sure that it will be appreciated and would certainly cause no hardship with the architects, contractors, or the owners, and I am quite sure that it will insure cooperation from the consulting engineer with the manufacturer. The consulting engineer's profession is today on a par with the architect's or contractor's profession and deserves equal consideration.

F. H. Valentine
Mayer and Valentine,
Consulting Mechanical Engineers,
Cleveland.

Determination of Sun Effect on Summer Cooling Loads

Editor, Heating and Ventilating:

Carl Shabtac, of Cornell University, has pointed out an error in the article under the foregoing title in the June, 1933 issue of Heating and Ventilating, pages 20-23. Equations (3), (4), and (5) and the discussion concerning them contain the fraction K_v/K_h. This fraction should be K_h/K_v throughout the article except in Equation (7) and the discussion concerning it.

Unfortunately, this error was carried over into the sample computation. It affects the unshaded transmitting area, $A_{1\text{-}2}$, and the heat reception, H, through the window. Corrected values of these are:

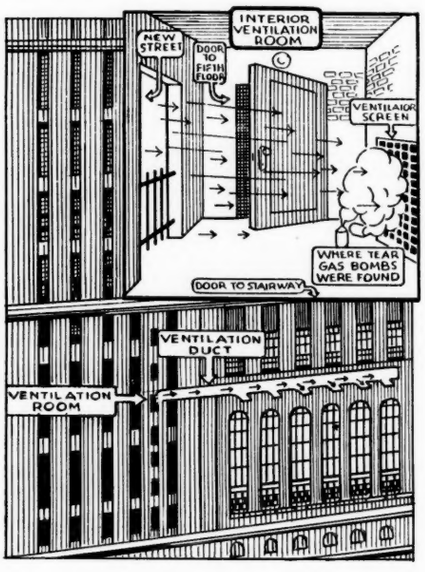
$$A_{1\text{-}2} = 3(6 + 0.2 - 1.5 \times 0.726 \div 0.667) = 13.7 \text{ sq. ft.}$$

instead of 14.5 sq. ft. given, and

$$H = (13.7 \times 0.667 \times 0.908 + 0.05 \times 18) \times 233 = 2151 \text{ B.t.u. per hr.}$$

instead of 2260 B.t.u. per hr. given.

G. A. Hendrickson
Detroit, Mich.



Sketches show where tear gas bombs were placed and how fumes were circulated in the New York Stock Exchange ventilating system, forcing the Exchange to close Friday, August 4. A young lawyer in Boston, arrested for planting the gas bombs, claimed it was done to bring attention of financial leaders to the spirit of unrest prevailing throughout the country.

First Completely Conditioned Office Building in East

C. E. Daniel, of the consulting engineering firm of Daniel and Wallen, New York, has called attention to an error in our caption in the August issue describing the new Metropolitan Life Insurance Building as the "first completely air conditioned office building in the East." Mr. Daniel writes:

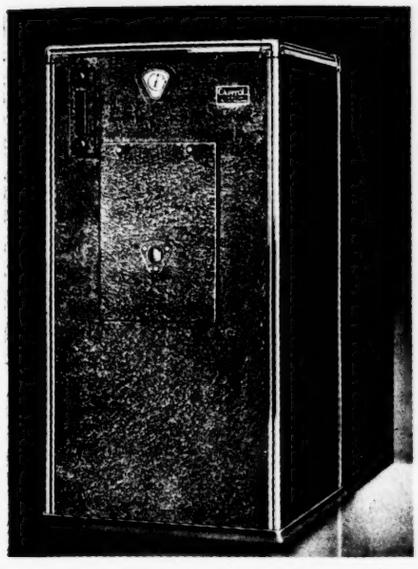
"The credit for the first completely air conditioned office building in the East is due Westchester County (New York), which also holds first place in parkways, public swimming pools, recreation centers, hot water distribution, etc. The Westchester County Office Building at White Plains has a complete air conditioning system for all offices. The air conditioning system for this building which has a cube of approximately 3,500,000 cu. ft., was designed, installed, and placed in operation prior to the system for the Metropolitan Life Building. This air cooling and dehumidifying system was placed in operation during the first part of June, 1932, while it is our understanding that the system for the Metropolitan Life Building was not completed until the fall of 1932, and that the cooling system was not used until the spring of 1933. . . . Morris and O'Connor were the architects, and Hauxwell and Smith were the contractors for heating, ventilating, and air conditioning, while this firm acted as consulting engineers."

New Equipment

Capitol Oil-Burning Boiler

United States Radiator Corp., Detroit, has announced the Capitol oil-burning boiler, furnished in two sizes, with steam capacities of 500 sq. ft. and 700 sq. ft. of direct cast-iron steam radiator load. The boiler is available in both steam and water types.

The steam boiler is equipped with a low water cut-off, a built-in Taco domestic hot water heater, and



Capitol oil-burning boiler

is designed for use with standard oil-burning controls.

The boiler develops high efficiencies, with low smokehood temperatures. Gases change direction of flow seven times in going through the boiler, reducing the possibility of stratification.

The boiler has large reserve capacity, sufficient to raise the temperature of the domestic hot water from 50° to 150° in 3 hr. It is insulated with rock wool and encased in a metal jacket.

New Method for Producing Coated Abrasives Developed

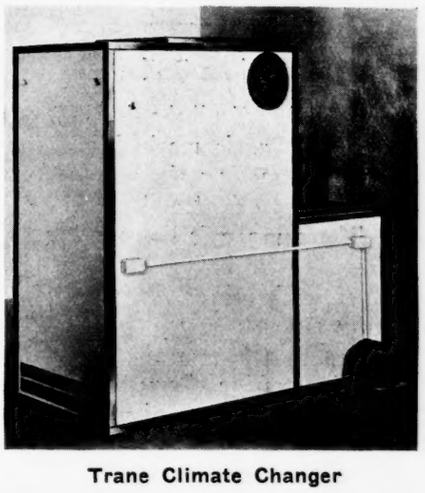
A recently developed electro-coating process has resulted in the marketing of improved coated abrasives in a variety of shapes and forms such as belts, discs, rolls, and sheets. Abrasive grain and backing materials of the usual kinds are available. It is said that these abrasives are more lasting as well as more effective.

Trane Markets All-Year Conditioner for Residences

Year 'round air conditioning for homes is offered in the Climate Changer, newly developed unit of The Trane Co., La Crosse, Wis. The system is of the forced air type, and is installed as a complete assembly including the oil or gas burner which is a product of the manufacturer.

Recirculated air is exhausted from the rooms and drawn through a dry metallic wool type filter into the unit by a centrifugal fan belt-driven by a motor mounted outside the casing. The air is then passed over a baffled heat exchanger with extended rib exterior. Before delivery to the supply ducts, the air is passed through a humidifier said to evaporate from 18 gal. to 20 gal. of moisture per day. Water enters the top of the humidifier from the supply line and flows by gravity down over a zig-zag channel providing 100 sq. in. of evaporating surface.

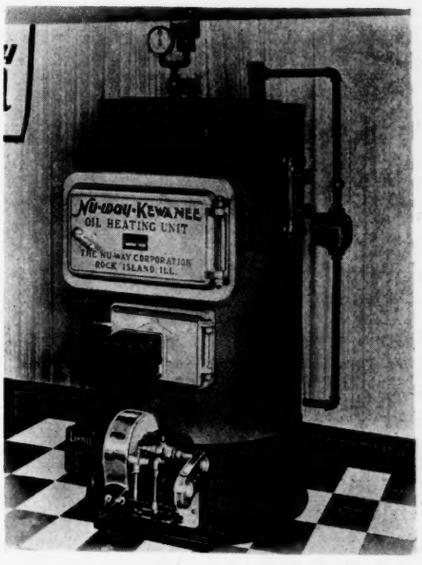
Automatic operation is controlled by a room thermostat and a furnacestat. As the thermostat calls for heat, the oil or gas flame is increased, and the furnacestat starts up the fan motor when heat builds up in the casing. The heater remains in operation until the desired temperature has been reached when the burner is shut down and the fan stops. The system is designed to deliver air at the register at 135°. Cooling coils may be installed between the fan casing and the heat exchanger casing, and either cold tap water or refrigerated water may be used in connection with the fan and filter for summer conditioning. The company provides engineering services, and a balanced system is assured by adjustment of dampers in the ducts.



Trane Climate Changer

Nu-Way and Kewanee Bring out Boiler-Burner Unit

The Nu-Way Corp., Rock Island, Ill., is marketing the Nu-Way-Kewanee automatic oil heating unit, a coordinated boiler-burner combination, in two sizes for residential steam and hot water heating systems. The boiler, of the round steel welded type, having large combustion space and horizontal double pass fire tubes with spinner blades to impart a whirling motion to the gases of combustion, was described on these pages in a previous issue.



Nu-Way-Kewanee boiler-burner unit

Burner was expressly designed for this boiler, and is mounted directly on the front of the base to form an integrated unit. Combustion chamber is lined with high temperature moulded refractory. The unit is equipped with a thermostat for regulating room temperatures, a boiler limit control for restricting temperature or pressure, a safety control, and a low water cut-off.

Capacity of the smaller size is

New Equipment

given as 540 sq. ft. of equivalent direct steam radiating surface, and that of the larger size as 680 sq. ft., with maximum fuel rates of 1.8 gal. and 2.3 gal. per hr., respectively. A submerged copper tube indirect water heater provides hot water for domestic use at the rate of 40 gal. every 3 hr., with a temperature rise of 100°.

New Humidistat Has Paper Element

Penn Electric Switch Co., Des Moines, Ia., has placed on the market the Type 840 humidity control for regulating the operation of small valves, fans, etc., in residential or commercial systems. It is attractively housed in a walnut brown moulded bakelite case, with an accurate thermometer mounted on the cover.

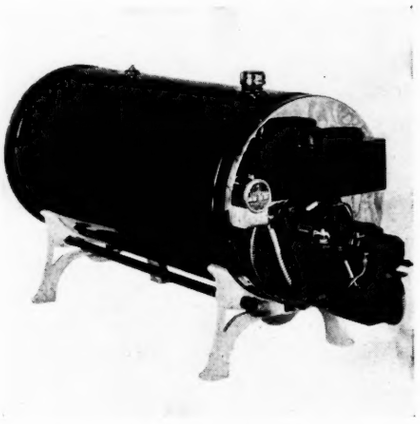
Hygroscopic element of this humidistat consists of a strip of treated paper wound on a corrugated spiral. One end of the strip is adjustable and the other is fixed to the spiral. The free end moves an armature to open and close an electrical circuit by contacts of a patented magnet construction. No strain is thrown upon the element at high humidity, and the instrument maintains accurate calibration at low humidities. The desired condition is obtained by setting an adjustment lever at the bottom of the case.

The control is rated for 25 volts at 2 amperes, or for 110-220 volts at 1½ amperes. Standard two-wire connections are made to binding screws on the base. The instrument has an operating differential of from 2% to 4% relative humidity.

Penn humidity control

Automatic Water Heater Announced by Nu-Way

An oil-burning automatic water heater has been placed on the market by The Nu-Way Corp., 2416 Fourth Ave., Rock Island, Ill. It has a storage capacity of 43 gal., and will heat from 50 gal. to 75 gal. of water per hour through a temperature rise of 80°.



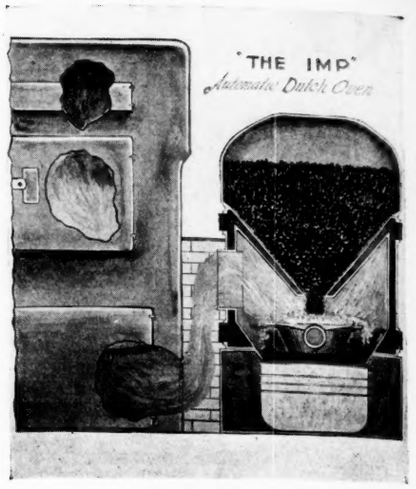
Nu-Way Genii automatic water heater

Tank is horizontal, with tubular fire travel, promoting rapid circulation and minimizing the formation of lime and scale. Burner may be used with No. 3, No. 2, or No. 1 fuel oil, and can be hooked up with the oil storage tank supplying the main heating equipment. It is equipped with electric flame ignition. The unit is 66 in. long, 29 in. high, and 22 in. wide.

Stokerless Boilers

The V. M. Cruikshank Utilities, Shamokin, Pa., is marketing a line of Imp automatic stokerless boilers, with magazine feed and coal burners. The company's line consists of various sizes of boilers and burners for application in connection with heating systems or with hot water heaters.

The illustration shows the Dutch Oven boiler, the top of which is a magazine with a funnel-shaped bottom, part of a water-backed section; underneath is a cylindrical burner to which the magazine feeds the coal in a cone-shaped pile about 3 in. or 5 in. below the coal outlet. The burner diameter varies from 9 in. to 19 in., depending on the size of the unit, the coal being driven across the burner surface by a rotating carborundum impeller. The impeller makes about 1 r.p.m. Air is supplied to the coal by a small motor-driven blower. After the coal has been burned it falls into the ashcan in the base.



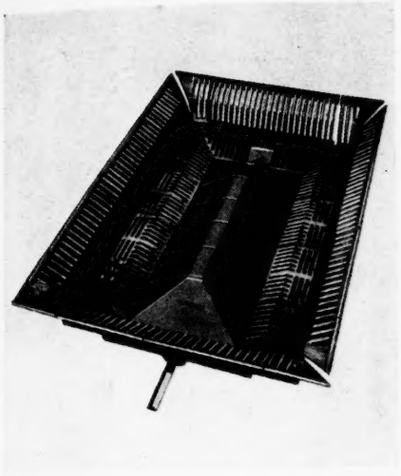
Imp Dutch oven

The usual application is for the unit just described to be connected to the ordinary heating system boiler at the ashpit. The Dutch Oven unit consequently acts as an auxiliary and its advantages consist in giving additional heating surface, acting as a magazine, and converting the installation into an automatic unit. In addition, grates of the regular boiler are left intact for immediate use in case of emergency. They also can be used as an incinerator. Smaller units for hot water are available which are complete in themselves. Thermostatic controls and other accessories are provided.

Soft Coal Burner Requires No Secondary Air

Flameking Co., Inc., 2159 Madison Ave., New York, is marketing the Flameking fuel burner, designed for smokeless combustion of bituminous coals in steam and hot water heating boilers. The manufacturer recommends it for either high or low pressure steam.

Burners are equipped with upright grates of unusual design, and solid base arranged to void ashes



Flameking fuel burner for rectangular boiler

with little effort. Sufficient air for complete and smokeless combustion of both the solid and volatile in the fuel is introduced uniformly throughout the fuel bed, and no secondary air is required. Materially reduced fuel costs, together with reduced labor and more uniform heat, are advantages claimed for this device.

Burners are furnished for both round and rectangular boilers in a complete range of sizes from 16 in. up, and can be easily installed without structural change to the existing heating plant.

Chart for Furnace Fan Selection

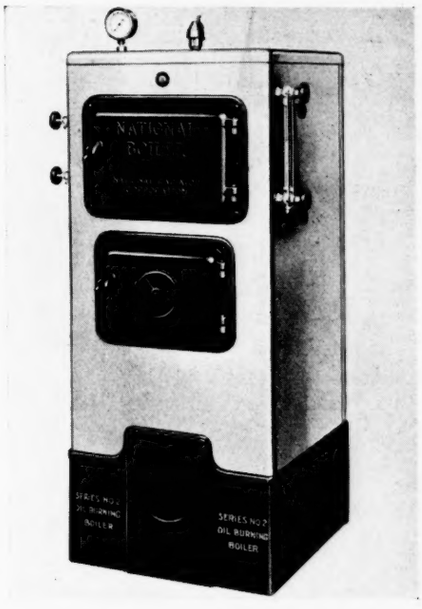
Air Controls, Inc., 1962 West 114th St., Cleveland, recent successors to The Warm Air Furnace Fan Company, has prepared a simplified furnace fan selector chart from which the c.f.m. requirements of any fan, regardless of make, may be read directly opposite the furnace capacity, given in firepot size, gravity pipe area ratings, or B.t.u. per hour. The chart lists also the correct Miles furnace fan for each furnace capacity, separate columns being provided for residential and for industrial service.

The chart is attractively mounted on heavy cardboard, suitable for notebook or wall use. A copy will be mailed on receipt of request to the company.

National Announces Oil-Burning Boiler

Designed expressly for oil firing is the series No. 2 oil-burning boiler, recently announced product of National Radiator Corp., Johnstown, Pa. It is manufactured in five sizes for both steam and hot water heating in a range of capacities suitable for most residential and small commercial requirements.

This boiler is of cast-iron construction, and is of the square sectional type with a double set of three horizontal flue ways. The combustion chamber is of ample size, and designed for efficient operation with any standard make of burner. Tappings are provided for connection to external water heater. An attractive enameled jacket, thoroughly insulated against heat loss and



National oil-burning boiler

noise transmission encloses the unit.

At the recommended heat transmission rate, available outputs range between 592 sq. ft. and 1055 sq. ft. of direct steam radiating surface, and from 948 sq. ft. to 1688 sq. ft. of hot water radiation.

Portable Furnace Cleaner Mounted on Trailer

Arco Vacuum Corp., Division of American Radiator Co., 40 West 40th St., New York, is building the Arco Wand boiler-furnace cleaner, mounted on a substantially constructed pneumatic-tired trailer to be towed to the job behind passenger car or truck.

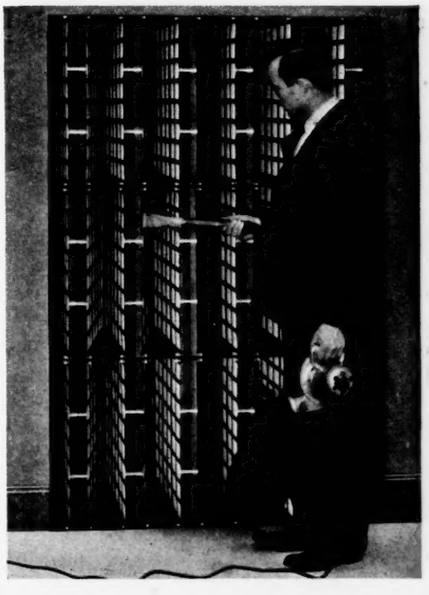
A positive displacement pump, driven by a compact gasoline motor, produces the vacuum. The separator is carried into the cellar and connected to the pump by a long hose and a shorter hose connects the separator to the proper working tools for cleaning the various parts of the heater. Accumulations of soot, scale, and ash are deposited in the separator bucket.

Standard equipment includes 50 ft. of 2-in. connecting hose with couplings, 17½ ft. of 1¼-in. working hose, observation glass, two 3 ft. suction handles, and various working tools to perform a complete job.

Multiple Surface Filter Requires Infrequent Cleanings

Multi-V-type air filters, recently announced product of Staynew Filter Corp., Rochester, N. Y., are designed for effective performance with a minimum of pressure drop.

Filtering medium is of the dry fabric type, folded with V-shaped corrugations into a lightweight fiber board cell frame and supported by metal reinforced fiber board spacers. The fabric is made up of closely compressed cotton, carefully distributed on both sides of a non-metallic gauze-like reinforcement. It is stated by the manufacturer that these cells will give from three to five months of service before cleaning becomes



Vacuum cleaning Staynew Multi-V-type air filter

necessary, and an ordinary portable domestic type vacuum cleaner, fitted with a nozzle designed to fit the pocket sections, quickly removes the entrapped dust and restores the filter to practically normal resistance.

Cells are made up in a range of sizes to permit assemblies and combinations to meet practically every industrial or residential requirement. Evenly spaced holes on all four sides of the frames permit fastening any number of units together with bolts, and spring clips are provided to hold the cells in position. A felt strip around the rear of the frames guards against dust leak between adjoining frames. The cells may be accordion assembled as illustrated where simultaneous removal or installation is desired.

Kauffman Announces Line of Coolers and Conditioners

A line of cabinet type room coolers and air conditioners for residential and commercial application has been introduced by the Kauffman Air Conditioning Corp., 4485 Olive St., St. Louis.

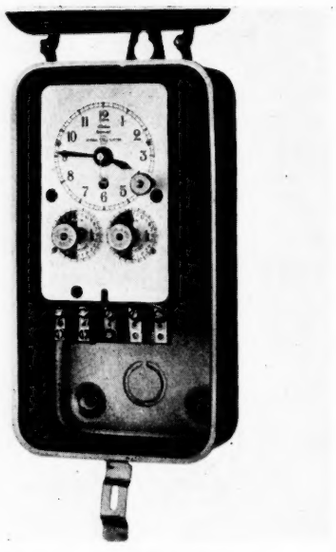
Floor-mounted air conditioners are available in both upright and window models in walnut grain-finished furniture steel. These contain heat transfer surface for both heating and cooling, and provision for humidifying, cleaning, and circulating the air. Either mechanical refrigeration, with compressor remotely located, or circulated ice water can be used for summer cooling, and steam or hot water may be chosen as the heating medium. The conditioner delivers 400 c.f.m., and the manufacturer states that it will supply 12,000 B.t.u. per hr.

Kauffman air conditioner

Self-contained room coolers operating by mechanical refrigeration are also marketed by this manufacturer. These are made in either ½-ton or 1-ton capacities, delivering 275 c.f.m. and 500 c.f.m., respectively.

G-E Markets Thermostat Timer

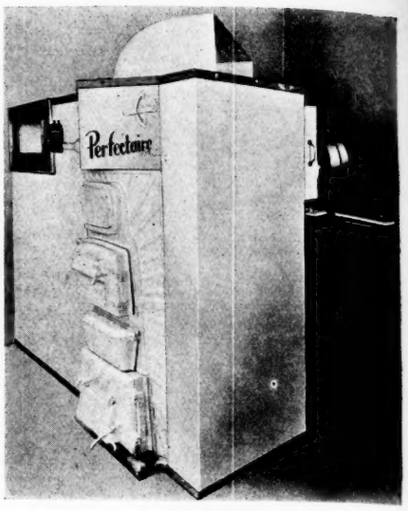
General Electric Co., Schenectady, N. Y., has announced a thermostat timer for use with the double range "day-and-night" type of temperature control. A telechron clock operates the switches and a dial is provided for setting for a.m. or p.m. time. Two other pointers are used to set the mechanism to the proper time setting for the day and night temperature regulators to be put into operation. The control is mounted in a rust-resisting drawn steel case, electrogalvanized and aluminum-sprayed.



G.E. thermostat timer

Perfectaire Conditioner

Air Conditioning Engineering Co., 171 Second St., Cambridge, Mass., has announced Perfectaire, a warm-air furnace type of air conditioning unit. It may be installed in old or new homes. The unit heats, cleans, humidifies, and circulates the air at a reported operating cost of 12 cents per day for electricity and water.



Perfectaire unit

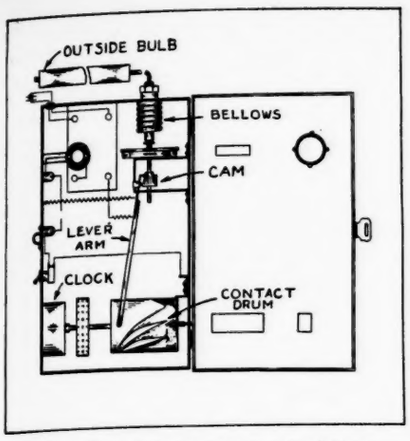
A conditioning chamber is provided to accommodate 300 lb. of ice, but the system is so designed that the blower operation is not required during mild weather. Refrigeration cost is said to be in the neighborhood of 1 cent per 1000 B.t.u. of heat removed.

Constant Level Valves for Burner Jobs

A line of constant level valves with or without strainers has been announced by the Detroit Lubricator Co., Detroit. Installation of these valves eliminates variations in fuel delivered to the oil burner due to differences in head pressures between that of a full and empty tank. The valves are installed in the gravity fuel line between the supply tank and the metering valve.

Temperature Control Regulated by Outdoor Temperature

Berwyn Regulator Co., 1933 South Clinton Ave., Berwyn, Ill., has developed the Tri-Trol system of temperature regulation for controlling the operation of hand or automatically-fired heating equipment or electrically-operated steam valves in accordance with outside weather conditions. Apparatus consists primarily of a fluid-filled bulb outside the building and an automatic switching device installed indoors. The time of starting up the heating plant in the morning and of



Tri-Trol temperature regulator

the closing down at night, in addition to the periods of operation, are all determined by the outside bulb, and manual adjustment is provided for compensating for variations in climate, load, and other variables.

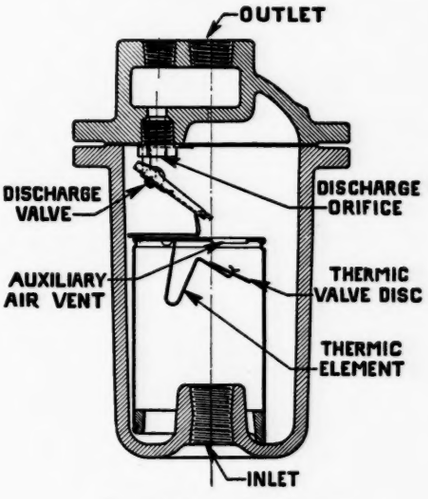
A rise or fall of outdoor temperature causes a variation in the pressure in the outdoor bulb, which is communicated to an expanding bellows in the control cabinet. Motion of the bellows is transmitted through a cam to a contact lever which moves laterally across the surface of a clock-controlled revolving contact drum. This contact rides on a path on the drum having shorter or longer periods of contact, depending upon the position of the lever arm, to meet the heating demand. As the lever contacts with a conducting portion of the drum, a circuit is completed which operates a relay to open a valve, or to start up the heating equipment. As the lever contacts an insulated portion of the drum, the circuit is broken. A hand-adjusted dial attached to the cam changes the inclination of the cam to the follower on the lever arm, to increase or decrease the period of heating as desired.

G-E Markets Small Gear Motors

Fractional horsepower gear motors for shaft speeds from 500 r.p.m. down to 11 r.p.m. for single phase, polyphase, or direct current operation have been announced by General Electric, Schenectady, N. Y. Motors are supplied in the concentric shaft type, utilizing Texolite helical planetary gears, in the worm reduction type with shaft at right angles to the motor axis, and in combinations of worm and planetary transmissions, resulting in a wide variety of drive shaft speeds. Capacities of 1/16 hp. to 3/16 hp. are available.

Inverted Bucket Trap Has Automatic Air By-Pass

Inverted bucket steam traps, manufactured by Armstrong Machine Works, Three Rivers, Mich., are now equipped with a thermostatic air by-pass for quickly removing air from unit heaters, pipe coil radiators, and similar heating applications. This consists of an auxiliary vent closed by a flat disc of stainless steel fixed to the end of



Inverted bucket trap

a corrosion-proof bi-metallic arm which is riveted to the bucket top.

When the trap is cold the valve is held open by the thermostatic arm and air escapes rapidly without floating the bucket and closing the discharge valve. When steam reaches the trap the disc is seated, preventing the escape of steam through the auxiliary vent. Thereafter, the trap functions in the normal manner, any air that is mixed with the steam being discharged through the regular fixed vent.

York Adds Air-Cooled Condenser to Freon Compressor Line

Air-cooled freon condensers for use in refrigeration installations where cooling water is not available or practical, have been announced by York Ice Machinery Corp., York, Pa. This equipment is designed especially for use in connection with the company's recently introduced line of freon compressors for commercial and air conditioning application. The condensers are designed to operate at evaporator temperatures up to 45°, a low-pressure temperature frequently required in air conditioning work.

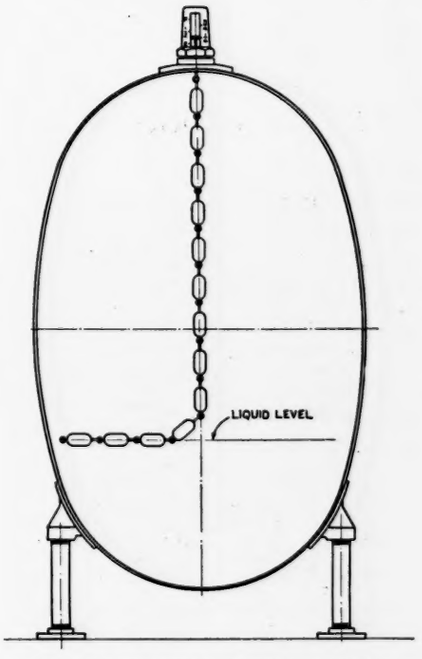
Air condenser is mounted in front of the compressor and motor, and air circulation is produced by two fans, one mounted on the motor shaft, and the other on the compressor flywheel. A sheet metal housing provides positive distribution of the air and protects the moving parts. The condenser is of the fin design, and has exceptional capacity.

New Equipment

Detroit Liquid Level Gauge

A liquid level gauge is one of the newer products of the Detroit Lubricator Co., Detroit. Attached to the gauge are a number of floats fastened together in the form of a chain. The gauge is actuated by the number of floats not supported by the liquid. Each unsupported float has the same weight irrespective of the specific weight of the liquid, making adjustment unnecessary.

The only information required for



Section of tank, showing liquid level gauge

ordering is that the vertical height of the tank must be specified. The manufacturer will then supply the correct number of floats and the proper spring. Gauges are stocked for tanks having a vertical dimension of either 27 in. or 42 in. Tanks with vertical dimensions other than standard can be supplied on special order at an extra price.

Temperature Controller for Duct Installation

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has introduced the Type L48, Type L68, and Type L93 indicating temperature controller for indicating and controlling the temperature of air, gases, or liquids in ducts, tanks, vats, or pipes. All models consist of a stamped housing with a cover containing a window which permits a

Type L48-4 temperature controller

view of the indicator and setting mechanism. Extending to the rear from the back of the case is the shaft and temperature sensitive element. The extension permits projection through the walls and up to 5-in. thickness. Operation is obtained from the expansion and contraction of a bi-metal helice.

Worthington Produces Improved V-Belt

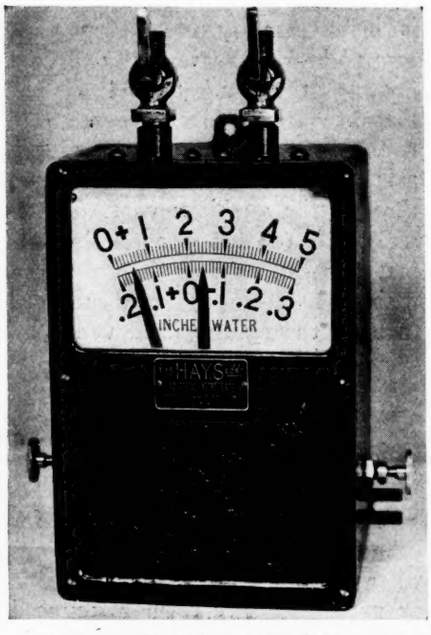
Goodyear Emerald Cord V-belting of improved design has been announced by the Worthington Pump and Machinery Corp., Worthington and Harrison Aves., Harrison, N. J., for use in connection with the Worthington Multi-V-Drive. Belts are trapezoidal in section, and are constructed to provide a concentration of the load carrying capacity about the neutral axis.

Load is carried by cords, embeded in rubber; a single endless cord in one layer in No. 0, 1, and 2 sizes, and two endless cords arranged in two planes in sizes 3 and 4. Layers of fabric are distributed through the compression section of the rubber to prevent excessive flexibility. Belts are molded to shape and are enclosed in a fabric envelope which protects the working elements and provides a contact surface for the sheave groove. This envelope fabric is cut with threads running at an angle to the direction of pull so that it is protected from carrying any part of the load. The manufacturer claims high capacity, long life, uniform cross-section, and low stretch as advantages of the new belt.

Dry Type Gauge Indicates Air Filter Resistance

A gauge for indicating the resistance to flow through air filters has been developed by The Hays Corp., Michigan City, Ind. The instrument is designated the Type B differential air filter gauge.

Connection is made to opposite sides of the filter bank at the cocks at the top of the air-tight case. When the pointer indicates the maximum resistance recommended by the filter manufacturer, the filter



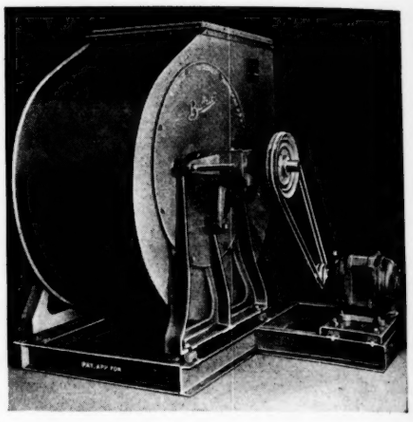
Hays Type B differential filter gauge

element is either cleaned or replaced. Gauges having ranges of either ½ in. or 1 in., with 0.01 in. and 0.02 in. divisions, respectively, are recommended by the manufacturer for most filter applications. Other scales are also available.

A slack leather diaphragm, spring balanced, is employed to measure the pressure differential applied to the gauge.

Buffalo Forge Announces Quiet Fan and Insulating Base

Quiet operation is claimed by Buffalo Forge Co., Buffalo, N. Y., for its new ventilating fan, mounted together with driving motor on the Buffalo silent floating insulating base.



Fan mounted on insulating base

Effective dampening of motor hum and vibrational noises is achieved through the use of flexible rubber insulators in the base, eliminating metal-to-metal contact between the bolts holding down base and fan. The rubber is subjected to shearing stress, and is said to maintain its useful life over a longer period than when used in compression.

Self-Serve Radiator Valve Package

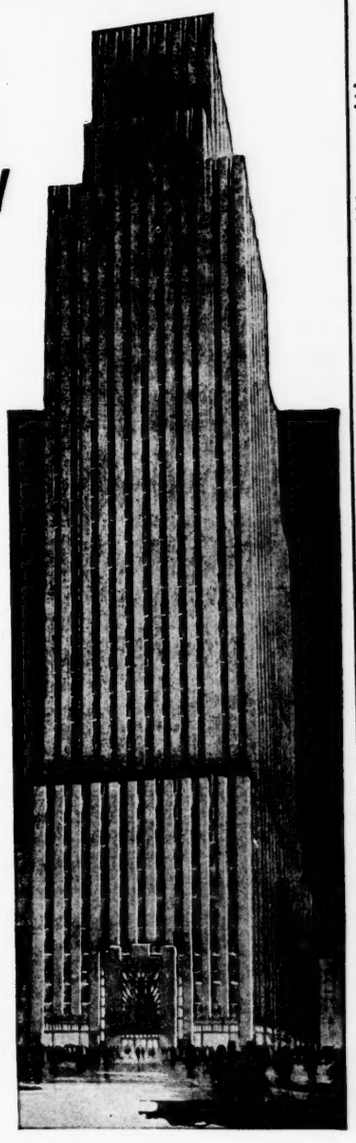
An interesting sales feature, the Valve-A-Teria, has been released by the Jas. P. Marsh Corp., 2073 Southport Ave., Chicago, manufacturer of radiator valves and other heating specialties. It is a merchandising package which, when placed on the counter, permits the purchaser to serve himself. Upon removal of one valve another automatically takes its place.

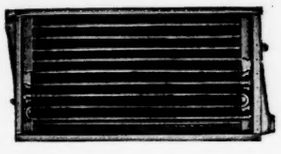
AEROFIN

IS THE HEAT-SURFACE FOUND IN THE

NEWS BUILDING

NEW YORK CITY





The Standardized Light-Weight Fan System Heat-Surface

4 Types 196 Standard Sizes

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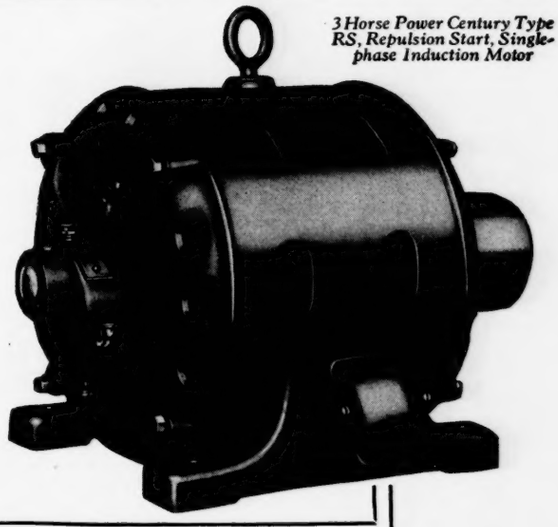
FOR AUTOMATIC OR REMOTE CONTROL . . . . . .

3 Horse Power Century Type RS, Repulsion Start, Single-phase Induction Motor



This motor is especially suitable where automatic or remote control is a requirement in heating, ventilating and air-conditioning installations... Where the location of motor driven equipment is inaccessible or inconvenient—the motor may be started and stopped by any approved manual or automatic control placed on a central control panel or other convenient location . . . The elimination of current-limiting starting equipment means economy in installation, maintenance and current consumption . . . Thousands upon thousands of these motors have satisfied the requirements of such installations . . . Consult Century Engineers about your motor application and control problems.

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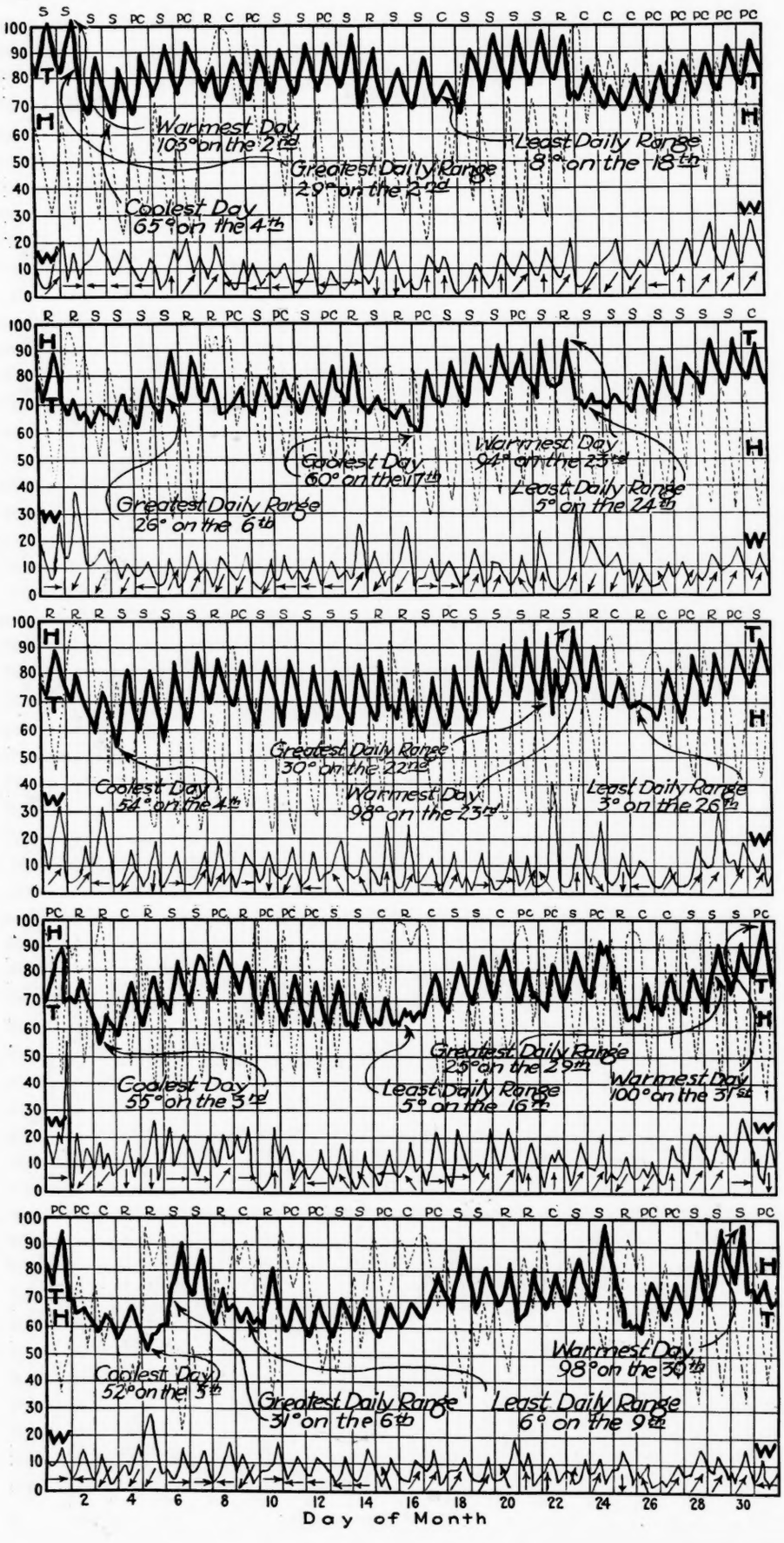
Start ● Stop ●

THE WEATHER FOR JULY, 1933

Plotted from records especially compiled for HEATING AND VENTILATING by the U. S. Weather Bureau. Heavy curves (T), temperatures in deg. F.; dotted lines (H), per cent relative humidity, from readings at 8 a.m., noon, and 8 p.m., except for New York, which shows hourly readings. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions. S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.


Warmest Day 103° on the 2nd
Greatest Daily Range 29° on the 2nd
Coolest Day 65° on the 4th
Least Daily Range 8° on the 18th
Coolest Day 60° on the 17th
Greatest Daily Range 26° on the 6th
Warmest Day 94° on the 23rd
Least Daily Range 5° on the 24th
Greatest Daily Range 30° on the 22nd
Coolest Day 54° on the 4th
Warmest Day 98° on the 23rd
Least Daily Range 3° on the 26th
Coolest Day 55° on the 3rd
Greatest Daily Range 25° on the 29th
Least Daily Range 5° on the 16th
Warmest Day 100° on the 31st
Coolest Day 52° on the 5th
Greatest Daily Range 31° on the 6th
Least Daily Range 6° on the 9th
Warmest Day 98° on the 30th
Day of Month

St. Louis

Mean temp. for month, 81.2°; aver. wind velocity, 9.9 m.p.h.; prevailing direction of wind, S.W.

Chicago

Mean temp. for month, 75.6°; aver. wind velocity, 9.0 m.p.h.; prevailing direction of wind, N.E.

Pittsburgh

Mean temp. for month, 75.0°; aver. wind velocity, 8.0 m.p.h.; prevailing direction of wind, S.W.

New York

Mean temp. for month, 73.7°; aver. wind velocity, 11.1 m.p.h.; prevailing direction of wind, S.W.

Boston

Mean temp. for month, 70.8°; aver. wind velocity, 8.0 m.p.h.; prevailing direction of wind, S.W.

Heating and Ventilating

OCT 13 1933

INDUSTRIAL PRESS, Publishers, 148 LAFAYETTE STREET, NEW YORK

Cincinnati Union Terminal—Main Concourse as seen from the driveway. The citizens of the Queen City are justly proud of this terminal which

OCTOBER 1933